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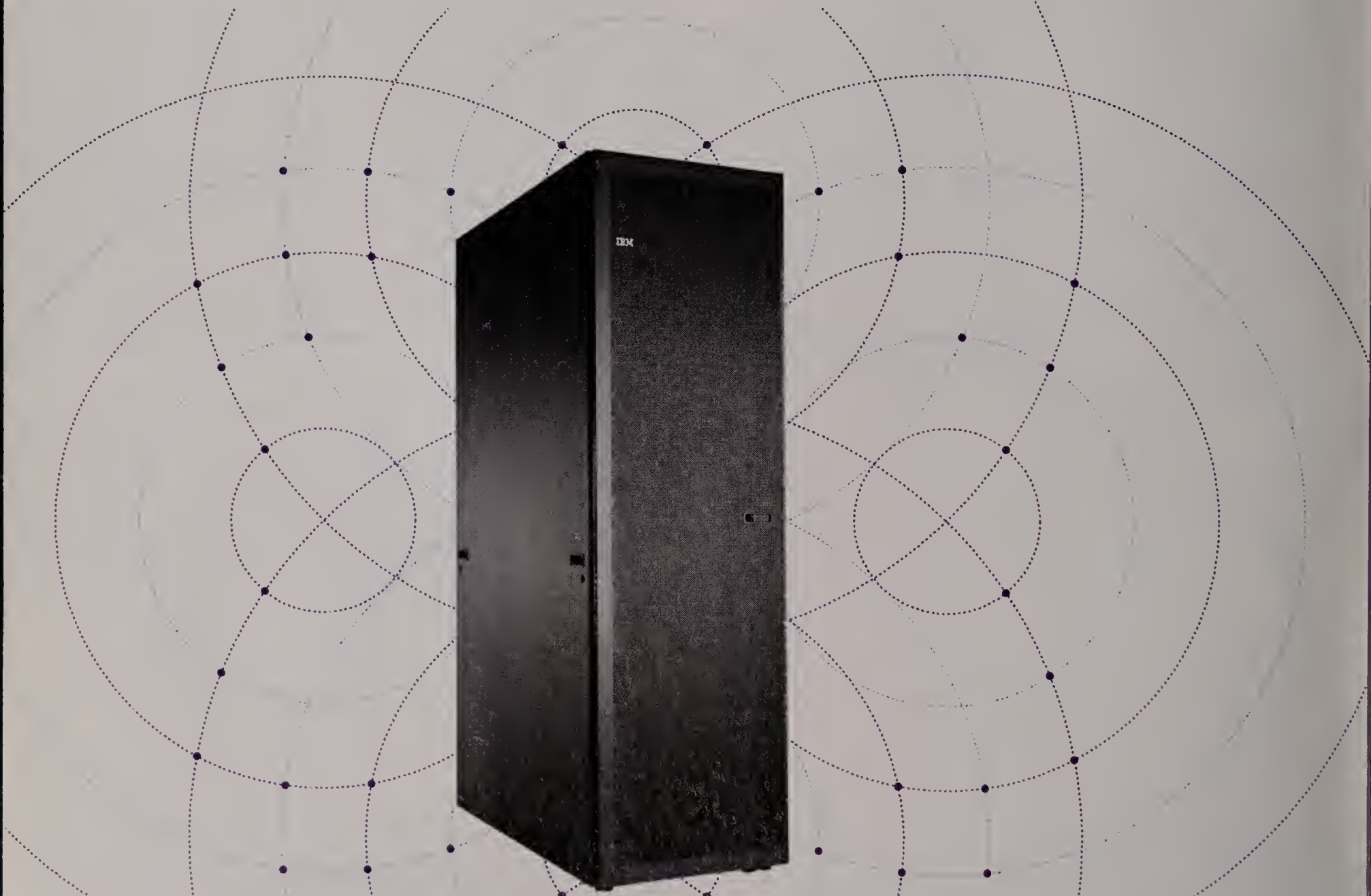

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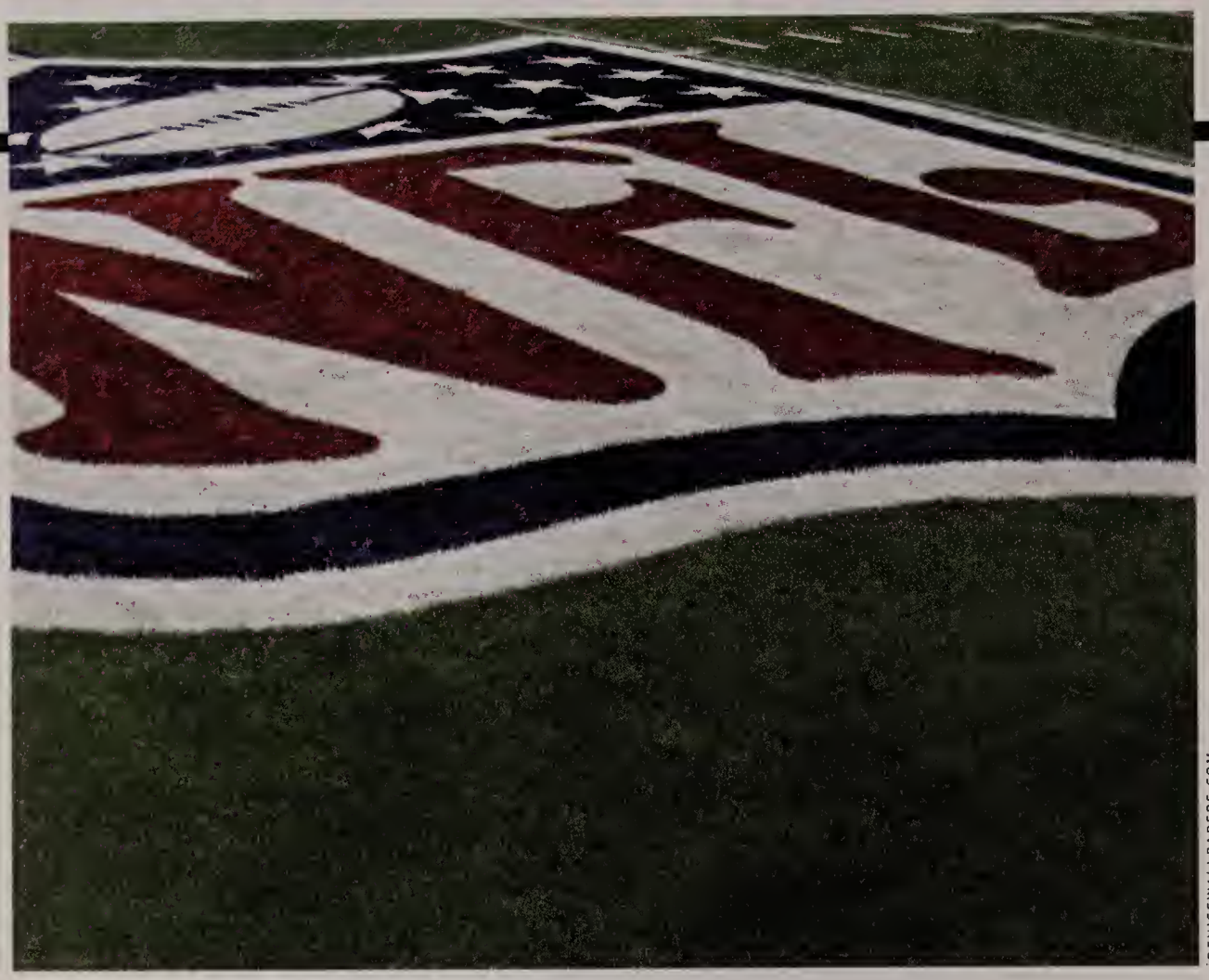
Heads Up



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APP DEVELOPMENT

EU: Programming Languages Can't Be Copyrighted

Europe's top court has ruled that the functionality of a computer program and the programming language it is written in cannot be protected by copyright.

The European Court of Justice made the decision in relation to a case that SAS Institute, a maker of statistical programs, brought against World Programming Ltd. (WPL), which develops and sells an interpreter for the SAS language.

Although WPL used and studied SAS's programs to understand their functionality, the court said, there was "nothing to suggest that WPL had access to or copied [SAS] source code." The court ruled that "the purchaser of a license for a program is entitled, as a rule, to observe, study or test its functioning so as to determine the ideas and principles which underlie that program."

If a function of a computer program could be specifically protected, that would amount to making it possible to monopolize ideas – to the detriment of technological progress, the court said. This echoed the opinion given in November by Yves Bot, the court's advocate general.

The ruling effectively leaves the door open for companies to reverse-engineer the software of others – in many cases without fear of infringing on copyrights.

– JENNIFER BAKER, IDG NEWS SERVICE

DATA CENTER

For the NFL, Big Is Better – Except in IT

THE NATIONAL FOOTBALL LEAGUE may have big stadiums, big players and big games, but when it comes to computer systems, the league's vice president of IT, Nancy Galietti, doesn't use the word *big*.

The NFL has three data centers — or server rooms, as Galietti calls them — that occupy about 2,000 square feet each.

The league has hired IBM to help it improve the efficiency of its IT operation. The goal is to keep operational costs flat but still meet demand for new services. To help accomplish that, the NFL has virtualized around 95% of its servers and is using virtualization to expand capacity without using new hardware.

Galietti said another tactic is to use private cloud services — and that sets the stage for an eventual move to the public cloud.

Steve Sams, an IBM vice president, said the company studied more than 300 of its customers and found that only one in five is operating at the highest level of efficiency — meaning it spends less than half of its IT budget on keeping data centers operational.

The organizations with the most efficient data centers have virtualized their servers and storage, Sams said. They manage more than eight virtual machines on a single physical server. In comparison, the ratio for "basic" data centers is 4.5 virtual machines per physical server. Highly efficient operations also use deduplication and a lot of automation.

Next up for the NFL: a statistics initiative, according to Galietti. Plans are still evolving in terms of the specific data that will be involved.

– *Patrick Thibodeau*

The ideal database system would have in-memory speed with persistence.

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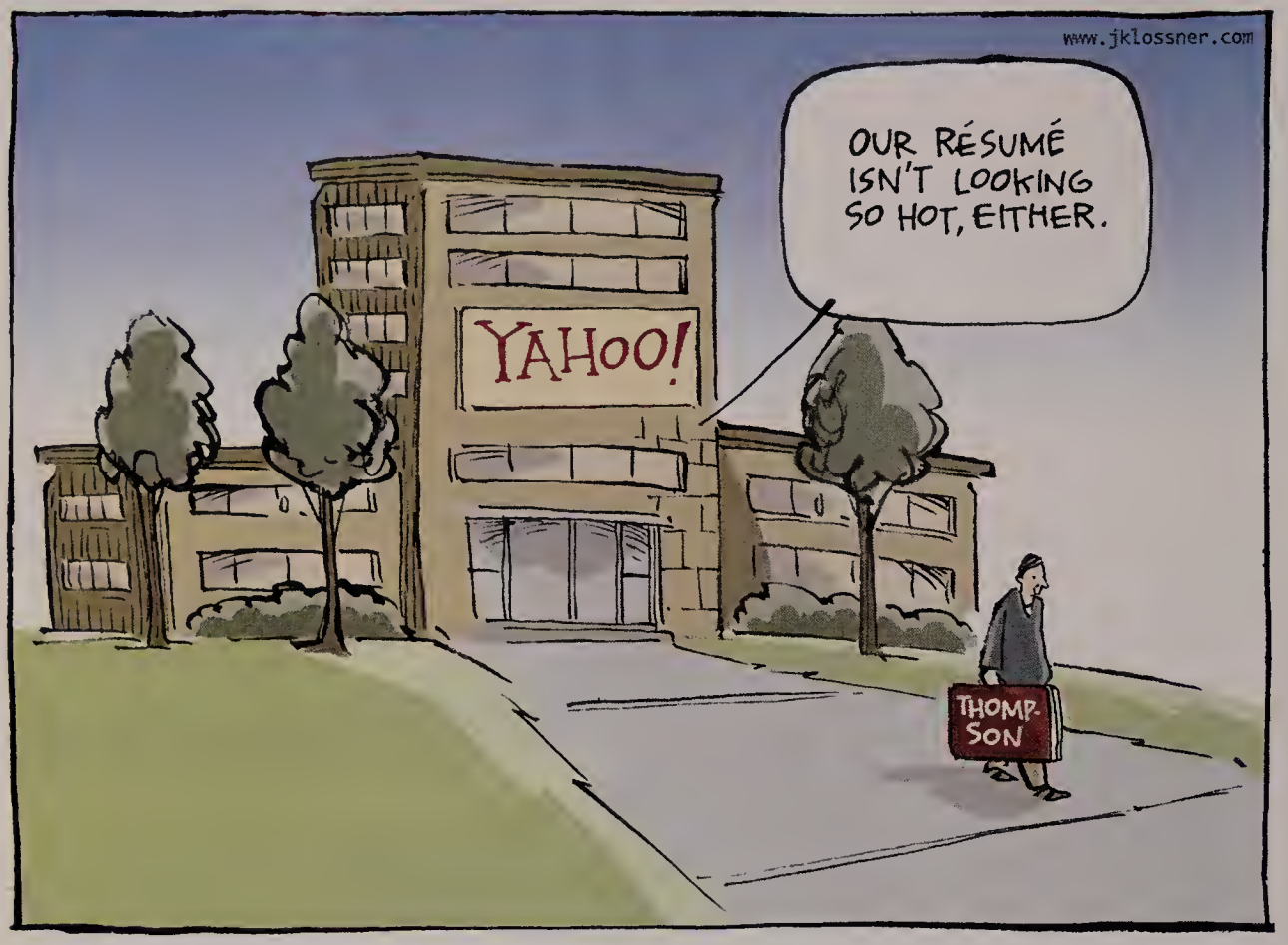
BETWEEN THE LINES
By John Klossner



CONSUMERIZATION OF IT

BYOD Is Driving IT 'Crazy,' Says Gartner

IT MANAGERS grappling with bring-your-own-device policies can expect to see an explosion in the number of smartphones and tablets used by employees in the next few years.

As a result, IT shops won't be able to provide the security necessary to protect company data, says Gartner analyst Ken Dulaney.

"The number of devices coming in the next few years will outstrip IT's ability to keep the enterprise secure," he said, adding that IT workers are "going crazy" and "get into fights" over whether users should have upgrades.

To help IT cope, software vendors should create what Dulaney called "beneficial viruses" that could be embedded in corporate data carried on mobile devices. These software tools would require users to have licenses in order to access files, just as digital rights management technology does with music and video files.

Beneficial viruses would also "be smart enough" to delete the sensitive data if a device is lost or stolen, or if data winds up on an unauthorized device, Dulaney said, adding, "It's time for the SAPs and Oracles to begin thinking about doing that, and it's a lot harder than we think."

Today, IT shops use mobile device management software to monitor which mobile users are authorized to access applications and whether they can access the data outside the corporate cloud.

Some companies are relying on a browser-based approach. American National Insurance Company, for instance, recently announced that it has extended PC-based customer information to mobile devices including iPhones, iPads and BlackBerry and Android devices. Agents can use mobile devices to search insurance policies and help customers sign up for insurance.

A Web-based approach was "the easier, quicker and right thing to do, and we didn't need to tap into the native device" to add applications, said Deanna Walton, assistant vice president of field systems for the insurance firm.

– Matt Hamblen

Micro Burst

In the first quarter, Apple's iPad accounted for

97.3%

of all tablets activated by enterprise users in the public and private sectors.

SOURCE: GOOD TECHNOLOGY

CAREERS

IBM Retirement Plan Promises Jobs Through '13

IBM is offering employees who are nearing retirement, and who might be worried about layoffs, a one-time opportunity to participate in a program that would guarantee their employment through Dec. 31, 2013.

The program, called "Transition to Retirement," would cut workers' hours and pay. But employees would continue to receive certain benefits, including company contributions to their 401(k) accounts, until the guarantee's expiration date.

According to a letter addressed to IBM managers, the program "offers participants 70% of their pay for working 60% of their schedule." Employees enrolled in the program would be exempt from any "resource actions" – meaning layoffs. In return, enrolled employees agree to retire on or before Dec. 31, 2013.

The letter was received by the Alliance@IBM/CWA Local 1701 union, which made it available. IBM confirmed the letter's contents.

At the end of 2011, IBM employed 433,236 people worldwide, up from 426,751 in 2010. In the U.S. specifically, IBM has been reducing its workforce; the most recent cutback occurred in February, according to the union. In 2006, IBM employed around 127,000 in the U.S.; now, that number is said to be around 95,000.

– PATRICK THIBODEAU

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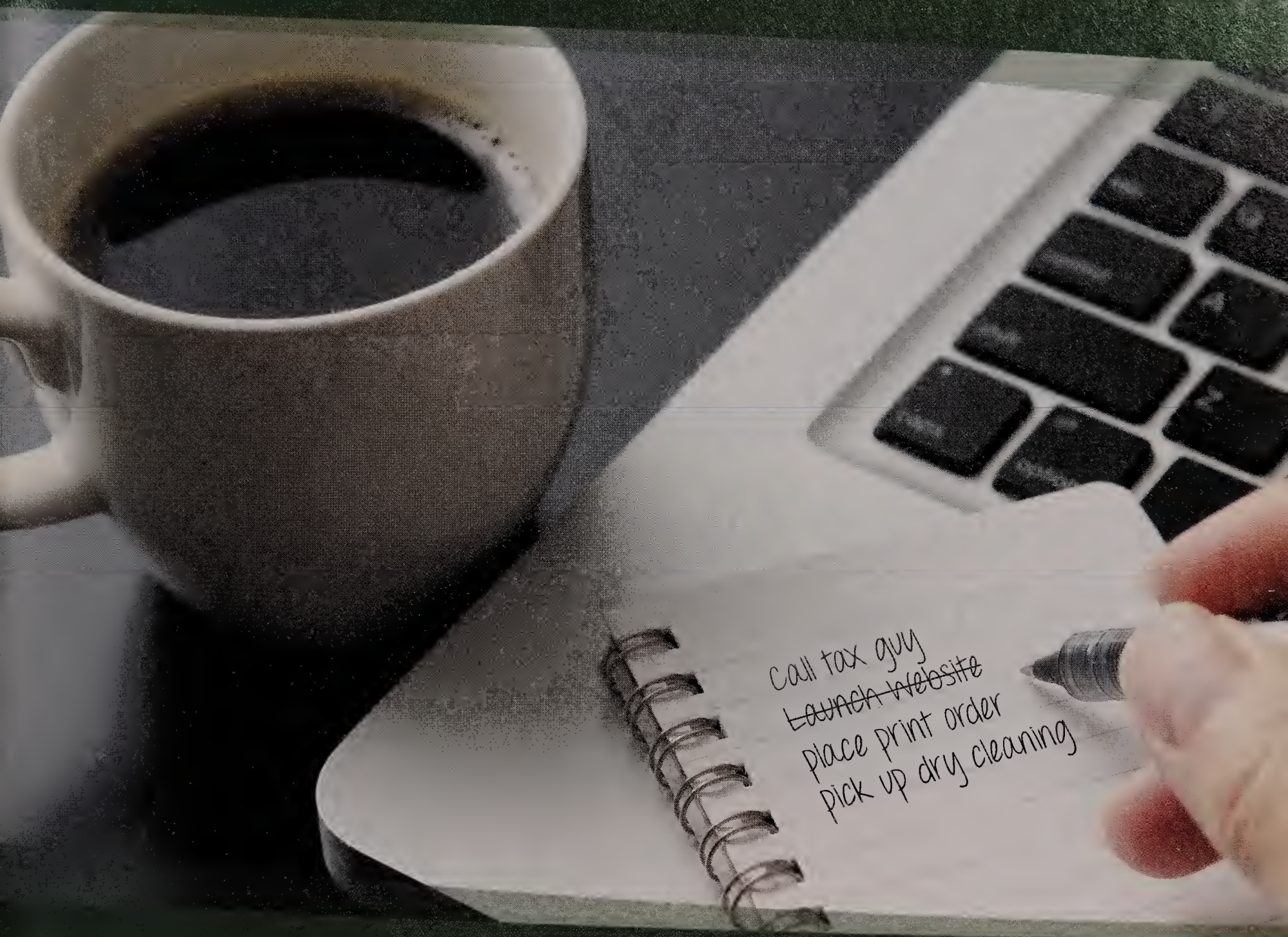
(before lunch)



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Consumers Energy is one of several Michigan employers dealing with an IT talent shortage.

Outsourcing Allows Utility to Refocus IT

Consumers Energy responds to Michigan's tech brain drain by outsourcing some tasks so internal IT can work on 'higher-value' projects. By Patrick Thibodeau

CONSUMERS ENERGY has hired an outsourcer to take over some of its day-to-day IT operations, and it hopes the move will allow its own data center workers to focus on projects that directly impact its bottom line.

Mamatha Chamarthi, vice president and CIO at the Jackson, Mich.-based utility, said internal staffers should now have more time to work on projects designed to help the company meet its goal of enabling employees and customers to access "any content, from any device, anywhere, anytime."

"They will be doing much higher-value work," she explained.

Most of the company's IT support tasks are being shifted to IT services provider HCL America, a Sunnyvale, Calif.-based subsidiary of India's HCL Technologies.

The outsourcer has also been charged with offering training to Consumers Energy IT staffers on subjects such as mobile technologies, according to Chamarthi.

The utility, which supplies natural gas and electric power to more than 6 million people in Michigan, has already started providing customers with first-generation mobile apps, and it's now working to expand the capabilities.

By the end of this year, company IT executives hope to have completed internal work on a portal that will make any information an employee needs quickly available on any device.

Chamarthi says the demands on her organization are increasing, as is the utility's investment in internal IT operations.

The company turned to an outsourcer to reduce contractor costs and increase automation. It set this condition, however: It would only use an outsourcer that created jobs in the state. Chamarthi was also worried about her ability to hire people, since the state's IT talent pool has been depleted by brain drain in recent years.

Between 2009 and 2010, Michigan lost an estimated 18,737 people who held degrees in the so-called STEM fields — science, technology, engineering and mathematics — while gaining 16,281 such individuals from other states and countries, according to data compiled by Ken Darga, Michigan's state demographer.

Chamarthi noted that of about 40 college computer science students who held internships at the company last summer, only three planned to remain in the state after graduating.

Other Michigan-based companies are also finding it difficult to recruit local IT professionals.

Detroit-based Quicken Loans, for instance, held a networking event in Palo Alto, Calif., to try to convince people with Michigan ties to return to the state and fill one of its 300 IT openings.

"The demand is definitely greater than a lot of folks realize," said Michelle Salvatore, director of recruiting at Quicken.

Company recruiters talked to about 100 people at the Palo Alto event, and Quicken plans to interview about 20 of them.

"One of our major goals is to show them Detroit, and show them that it's a cool, hip place to be," Salvatore said.

Quicken, which handled $30 billion worth of retail homeowners loans last year, is looking for a range of skills: engineers, business analysts, database administrators, Salesforce.com experts, .Net developers and "anyone in the BI world," said Salvatore.

HCL may face hiring problems of its own in Michigan: It plans to open a development center in Jackson in the next three or four months to service Consumers Energy and other local clients. The facility will initially employ 100 people, and HCL has said the total will increase to about 500 over the next few years. ◆

> One of our major goals is to **show them Detroit,** and show them that it's a cool, hip place to be. – **MICHELLE SALVATORE,** DIRECTOR OF RECRUITING, QUICKEN LOANS

LANE MONTGOMERY

Funds Pour Into Big-Data Vendors

Investors jump on the big-data bandwagon. Many see it as a good bet, but others warn about hype. By Jaikumar Vijayan

INVESTORS HAVE TAKEN NOTE of the surging enterprise demand for tools that can manipulate and analyze massive volumes of structured and unstructured data.

In recent months, top venture capital firms have poured hundreds of millions of dollars into companies that make products designed to manage so-called big data, generally defined as very large and diverse sets of structured and unstructured data gathered from a websites, clickstreams, email messages, social media interactions and the like.

Venture capital firm Accel Partners has even established a $100 million fund to finance big data vendors that are in the early stages of growth.

One of the latest beneficiaries of the largesse is software maker Birst, which this month disclosed that it had received $26 million in funding from Sequoia Capital, Hummer Winblad and DAG Ventures. To date, Birst has raised $46 million overall.

Birst was launched in 2005 as a cloud-based business intelligence service, and more recently positioned its cloud-based and on-premises products as tools for analyzing and gleaning intelligence from petabyte-scale data sets.

Birst is just the latest provider of big data tools to feel investor love.

In November, Cloudera closed a $40 million round of funding led by Ignition Partners, Greylock Partners and Accel Partners. Cloudera, which sells and supports a commercial version of the open-source Hadoop big data technology, has so far raised more than $75 million overall from investors.

Meanwhile, Cloudera rival MapR has raised more than $25 million; 10Gen, maker of the MongoDB big data database, has secured some $32 million; and DataStax, a provider of products based on Apache Cassandra database technology, has raised $11 million.

And the list goes on.

Greg McDowell, an analyst at investment banker JMP Securities, said that the investor interest stems from massive enterprise demand for tools that can manage data stores that are growing at breakneck speeds.

> “Big data has become big business.”
> – **GREG McDOWELL**, ANALYST, JMP SECURITIES

He added that investment firms clearly noticed last month’s initial public offering of big data software maker Splunk that raised about $230 million.

“Big data has become big business,” McDowell said. “Companies are looking for tools to store, manage, manipulate, analyze, aggregate, combine and integrate data.”

A key driver of the data explosion is the spread of cloud computing, mobile computing and social media technologies, along with business globalization, he said.

McDowell estimated that the market for big data tools will rise from last year’s $9 billion to $86 billion in 2020, when spending on big data tools will account for some 11% of all enterprise IT spending.

Curt Monash, an analyst at Monash Research, noted that startup big data firms ignored by venture capitalists may find that they’re attractive to established data management vendors like IBM, Oracle and Microsoft, which are increasingly looking to buy their way into the big data business.

At the same time, though, Monash warned investors to beware of the hype surrounding the technology.

“A great example of hype is anybody calling Birst a ‘big data’ or ‘big data analytics’ company,” he said. “If anything, Birst is a ‘little data’ analytics company that claims, as a differentiating feature, that it can handle ordinary-sized data sets as well.”

“The great growth in database sizes is both caused and balanced out by Moore’s Law,” Monash added. “The net effect is healthy but not enormous growth in the overall data management and analytics markets.” ◆

ISTOCKPHOTO

THE Grill

Barbie Bigelow

This CIO got to build an IT organization from scratch — in one short year.

A little-known fact about you:
I did outrun a bear one time. This happened in the Smoky Mountains in Tennessee. I threw a bowl of food at him and ran.

What's your favorite technology?
Everything. I'm a geek at heart. I'd be happy to spend Labor Day weekend putting in a wireless network and getting the printers to work wirelessly.

What do you like to do to unwind?
Wine tastings. I've also taken up yoga.

What was your first job?
Picking dandelions. My dad was making dandelion wine, and I got a nickel a bucket. It takes a lot of dandelions to fill a bucket.

"Ask me to do anything but ...
Load the dishwasher."

PHOTOS COURTESY OF TASC INC

AFTER SPINNING OFF *from Northrop Grumman in 2009, TASC had one year to establish itself as an independent company. That meant the 6,000-employee systems engineering operation needed to deploy a new IT infrastructure. In overseeing that effort, TASC CIO Barbie Bigelow built an IT organization and infrastructure from scratch. Her team spent about eight months working with 64 vendors and partners to design and build an operation that included a new ERP system, more than 4,000 computers, 800 mobile devices, 400 network devices and 134 data circuits across 60 facilities — and they did it in six weeks. Here, Bigelow discusses the failures and successes that the team experienced as they pursued the aggressive schedule, and she reflects on how TASC's IT unit has evolved.*

How would you describe the challenge you faced when you started as CIO of TASC?
Our mission was to stand up a new corporate infrastructure for the newly independent

Continued on page 14

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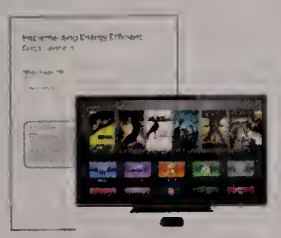

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Schneider Electric

> TASC is a different business than [Northrop Grumman].... **We had the opportunity to take a clean sheet of paper.**

Continued from page 12

TASC and to execute that transition while we continued to perform for our customers. What's unique about the challenge is that we had to do this in less than a calendar year, and a lot of activities had to happen concurrently. The divestiture happened at the end of 2009, and we had to be independent at the end of 2010.

Were you tempted to simply replicate the IT infrastructure that users were familiar with? Yes. We certainly did some analysis around that. But TASC is a different business than the big defense manufacturing company we were coming out of. Those processes and systems weren't right for us, and frankly they had grown up over a long period of time. We had the opportunity to take a clean sheet of paper.

What was your strategy? It was a three-step process. We had the acquisition strategy; we had to design and build and integrate; and then we had the transition phase, which was about six weeks.

You cut everything over in only six weeks? Yes. The transition plan was actually two tightly integrated plans, one for the ERP system and one for the infrastructure. Then we worked the change management and data integration horizontally across everything and worked very closely with the executive leadership team to make sure we were all in sync.

There were 64 partners and vendors involved, and these interdependencies all had to be laid out. We are talking about a new security system for everyone, 15TB of data, well over 100 data circuits and 100 voice circuits, and all of those things had to come together.

How did you approach the design challenge? TASC is a systems engineering and integration company, and I came into this with some experience on optimization of IT portfolios, so we leveraged that discipline. We were very disciplined with our program management methodology. We laid out a plan, as well as a risk mitigation plan of what to do if something went wrong.

I'm not going to say things didn't go wrong. We had equipment that didn't get delivered when we thought it would. We had things come in that were not what we expected. But because we had been through the process, the team was ready. And they were all in. Everyone was committed.

How did you go about building your data center infrastructure? We leveraged the commercial industry to accelerate our timelines. For example, we partnered with Unisys Global Managed Services to stand up the hosting and end-user services piece of this, and Unisys brought ITIL processes for building and managing the infrastructure. They live and breathe this every day.

Did you experience any failures along the way? One of the things we wanted to do differently in this transition was to have a really great collaboration environment, and from a technology standpoint I'd say we do. But it's really not about the technology. It's about the content. We didn't work enough on helping people get their content into the new environment and on helping people understand how that could help them.

Now we're focusing on content and the change management aspect of that, a process that helps people understand how to share and the rewards of sharing. This is more on the people side than the technology side.

Many ERP projects with longer time horizons fail. What allowed you to get yours done successfully under such a tight deadline? We had a fantastic team, and some folks had been through a couple of ERP transitions and understood our business processes very well. We were able to take that team and combine it with our partners to create a very accelerated plan.

What are your priorities for 2012? The things I'm most passionate about are mobility and accessibility for our employees. Many of our folks don't work in a traditional office environment that's connected to our network. They need the flexibility to access the tools and content they need from the environment they're in, using the device they have.

What advice would you give other CIOs? The talent you have around you is really, really important. Be very clear on what's important and what your criteria are across the whole enterprise, and empower the team to do that analysis and make the decision.

– *Interview by* **Robert L. Mitchell**

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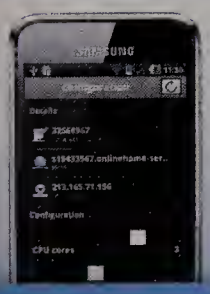

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S.J. VAUGHAN-NICHOLS

I, Robot Owner

Are we ready for robots that share our highways and homes? We'd better be, because they're coming.

Steven J. Vaughan-Nichols has been writing about technology and the business of technology since CP/M-80 was cutting-edge and 300bps was a fast Internet connection — and we liked it! He can be reached at sjvn@vna1.com.

WE'RE USED TO ROBOTS — IN THEIR PLACE. Think of a car factory; the image that comes to mind is probably not the assembly line of yore, but instead pivoting robot arms doing mind-numbingly repetitive tasks with great precision. But other than vacuum cleaners and the odd robotic pet, robots are mostly absent from our daily lives. Are we ready for that to change, with robots sharing our highways and homes? We'd better be, because they're coming.

On May 7, Nevada became the first state to issue a license for self-driven cars. These Google-developed cars are also known as autonomous vehicles, but make no mistake: They are robots.

The Google robot cars drive themselves using an onboard computer, cameras and a Velodyne 64-beam laser range finder mounted on the roof. This constantly creates a detailed 3D map of the environment. The car then combines its "vision" of its surroundings with GPS data to drive itself while avoiding obstacles and respecting traffic laws.

Why does Google think we need robot cars? As Jay Nancarrow, a Google spokesperson, explained, "Over 1.2 million people are killed in traffic worldwide every year, and we think autonomous technology can significantly reduce that number."

We all think we're good drivers. Just about every American guy is convinced he could show NASCAR drivers a thing or two. But the reality is we're pretty awful behind the wheel. Even though 2010 saw record low U.S. traffic fatalities, they still numbered 32,788. By comparison, 711 coalition soldiers died in Afghanistan that year.

Of course, Americans have always liked the autonomy that the automobile provides, and it's going to be a tough sell for us to hand over that autonomy to the car itself. Still, I suspect that we'll see self-driving cars in most states by the end of the decade.

But driverless cars are just machines that look like slightly modified cars (mostly Priuses, in fact). What about machines that look like, *gulp*, us? Robots that we see on the street and share our homes with. Are we ready for those? We'd better be, because we're on the verge of encountering humanoid robot firefighters, elder-care assistants and even sex dolls. Some robots, like those of the Geminoid series, are getting uncomfortably close to being able to fool a casual observer into thinking they're people, not machines.

What hasn't kept pace is artificial intelligence. Yes, we now have expert systems like IBM's Watson, which dominated human opponents in a *Jeopardy!* match. That technology isn't just for games, though. It's now being used at Memorial Sloan-Kettering Cancer Center to help physicians diagnose and treat patients.

True, no computer has ever passed a Turing test, and we have yet to see something like Commander Data, the android from *Star Trek: The Next Generation*. But I believe that in our lifetimes we will get expert systems, if not true artificial intelligence, that can pass for humans, first over the Web and later "in person" when used in humanoid robots. I can see them from here.

By 2030, I expect we'll be riding in robot cars and being tended by robot helpers. Will they incorporate Isaac Asimov's Three Laws of Robotics? We might want to think about that. After all, robots are already used in another human endeavor: war. At a time when we're considering using unmanned drones to patrol our airspace, we need to acknowledge that these are no longer just science-fiction plot devices, but real issues that demand real answers. ◆

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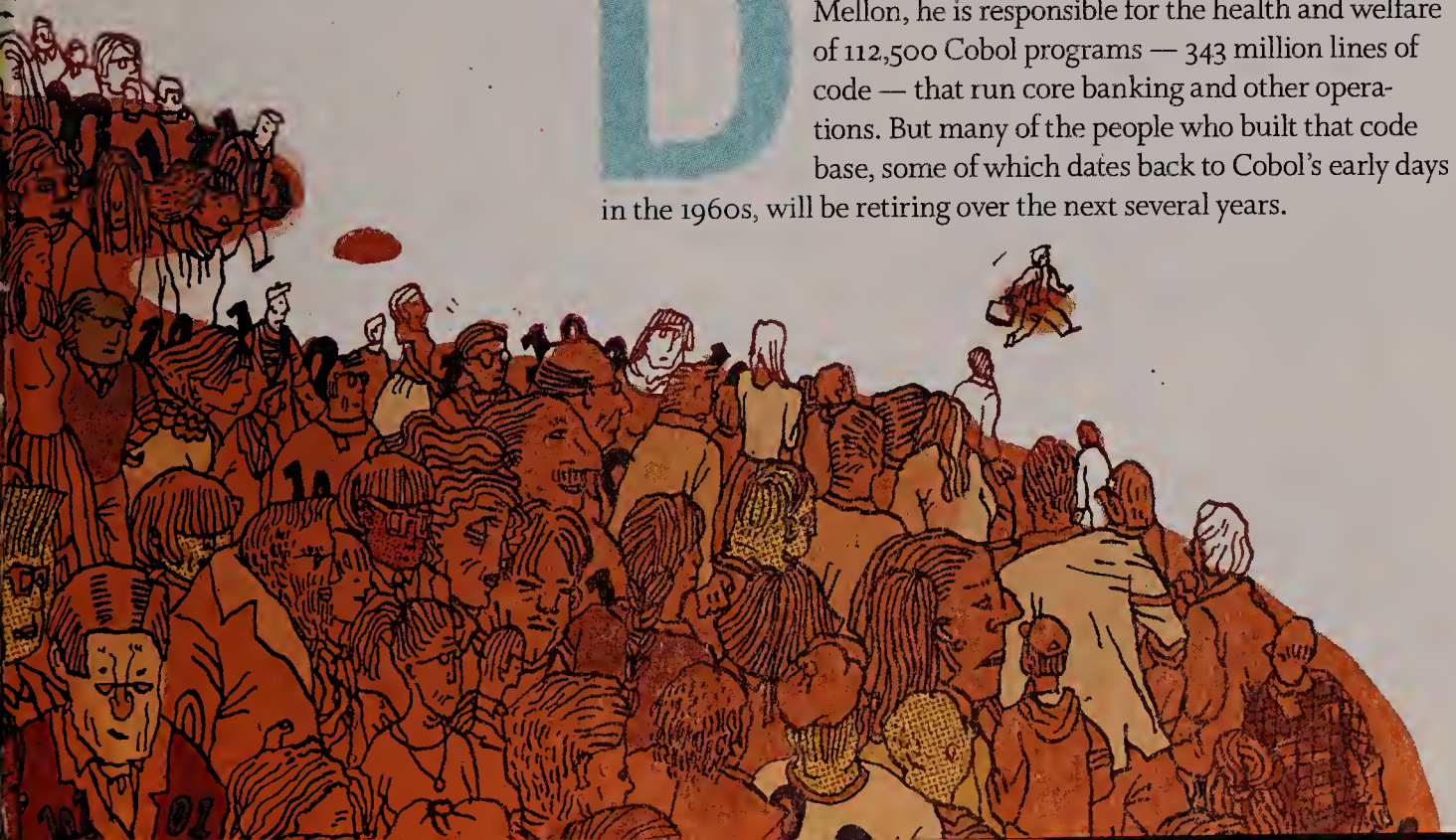
THE Cobol BRAIN DRAIN

When the last Cobol programmers walk out the door, so may **50 years of business processes** within the software they created. Will you be ready?

BY ROBERT L. MITCHELL

VICTO NGAI ILLUSTRATION



DAVID BROWN IS WORRIED. As managing director of the IT transformation group at Bank of New York Mellon, he is responsible for the health and welfare of 112,500 Cobol programs — 343 million lines of code — that run core banking and other operations. But many of the people who built that code base, some of which dates back to Cobol's early days in the 1960s, will be retiring over the next several years.

"We have people we will be losing who have a lot of business knowledge. That scares me," Brown says. He's concerned about finding new Cobol programmers, who are expected to be in short supply in the next five to 10 years. But what really keeps him up at night is the thought that he may not be able to transfer the deep understanding of the business logic embedded within the bank's programs before it walks out the door with employees who retire.

More than 50 years after Cobol came on the scene, the language is alive and well in the world's largest corporations, where it excels at executing large-scale batch and transaction processing operations on mainframes. The language is known for its scalability, performance and mathematical accuracy. But as the boomer generation prepares to check out of the workforce, IT executives are taking a fresh look at their options.

In a recent *Computerworld* survey of 357 IT professionals, 46% of the respondents said they are already noticing a Cobol programmer shortage, while 50% said the average age of their Cobol staff is 45 or older and 22% said the age is 55 or older.

"Organizations are trying not to get backed into a corner because of the skills issue," says Paul Vallely, mainframe sales director at software vendor Compuware. "I haven't seen companies move off mainframes due to the Cobol skills shortage yet, but it's looming."

For Bank of New York Mellon, which bought its first mainframe in 1955, keeping the core Cobol applications that run the business on the mainframe makes sense. Modernization efforts have made BNY Mellon's Cobol-based programs more accessible through the use of Web services and up-to-date user interfaces.

But for some noncore applications, and for smaller workloads, organizations have been gradually migrating off of mainframes — and away from Cobol. In several cases, Cobol programs are simply rehosted on Linux or Windows servers; in other cases, they're rewritten in object-oriented languages; and some programs are being replaced with packaged software.

"Over the past five years, there has been an acceleration of [some] businesses moving off host platforms," says Adam Burden, global application modernization lead at Accenture. That often means leaving Cobol behind by either rewriting it for J2EE or .Net or moving to packaged software.

Gartner estimates that the world has seen a decline of about 5% in total Cobol code over the past few years. Much of that involved migrations by small and midsize mainframe shops that move off what they see as a legacy language when they retire the hardware, says analyst Dale Vecchio. They're using other building blocks to develop their systems. "Cobol is no longer needed," Vecchio says. "There are alternatives."

Rehosting can get code off the mainframe quickly. One vendor that caters to users considering that option is Rockville, Md.-based Micro Focus, whose offerings include a system that will support Cobol programs on a Microsoft Azure cloud.

But rehosting is often seen as just an intermediate step on the way to completely modernizing and transforming Cobol systems.

Cobol's Image Problem

A procedural language, Cobol is not perceived to be as agile as object-oriented languages for modern programming needs such as mobile apps and the Web. And despite the availability of state-of-the-art Cobol development environments — including IBM's Enterprise Cobol on the mainframe and Micro Focus's Visual Cobol,

Continued on page 22

AN ENDURING Lure

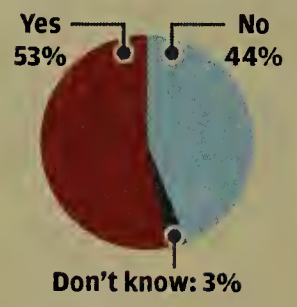
Organizations are trying to move off Cobol, but they still like it for a lot of reasons.

To what extent does your organization use these programming languages?

Language name	A lot	A little	None
Cobol	48%	16%	36%
JavaScript	41%	41%	18%
Java	39%	40%	21%
C#	26%	25%	49%
VB.net	25%	38%	37%
Visual Basic	22%	49%	29%

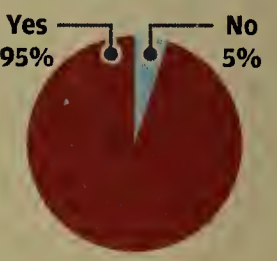
Base: 208 IT professionals

Is Cobol being used in your organization to develop new business applications?



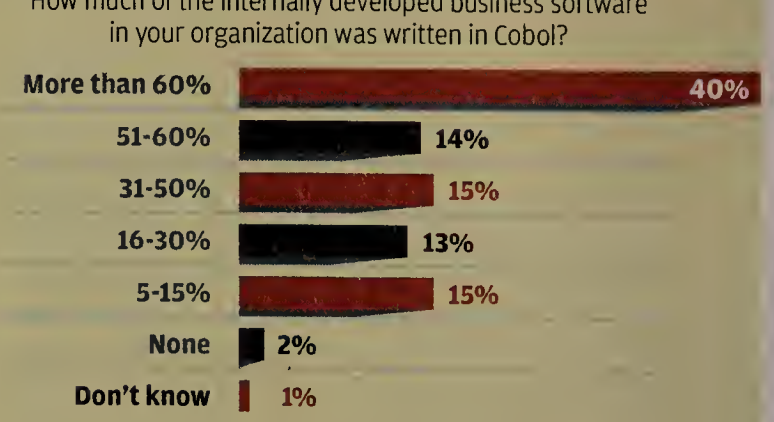
Base: 131 IT professionals

Is your organization still using Cobol to maintain applications originally written in Cobol?



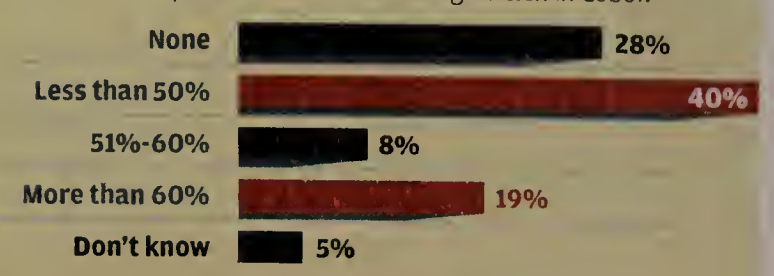
Base: 131 IT professionals

How much of the internally developed business software in your organization was written in Cobol?



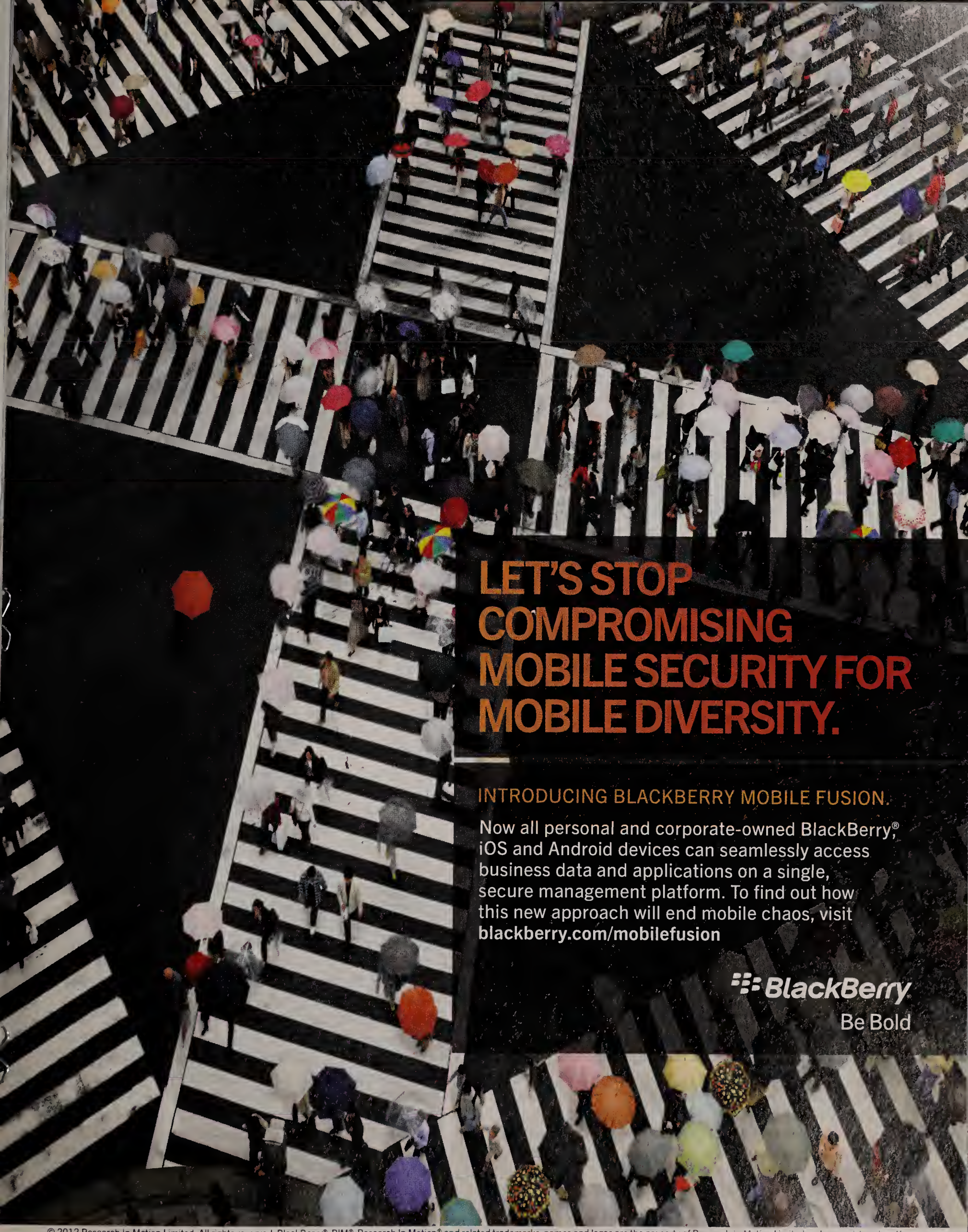
Base: 131 IT professionals

How much of your new software is being written in Cobol?



Base: 131 IT professionals

SOURCE: EXCLUSIVE *COMPUTERWORLD* SURVEY, FEBRUARY-MARCH 2012



Continued from page 20

which integrates well with Microsoft's Visual Studio development suite for .Net — Cobol is widely viewed as a legacy language.

Nearly half (49%) of the *Computerworld* survey respondents whose organizations don't use Cobol said the reason is that the language is simply outdated.

Not everyone agrees, of course. "Cobol has had lasting value, and it's not broken," says Kevin Stoodley, an IBM fellow and CTO of enterprise modernization tools, compilers and security at IBM.

A majority of the *Computerworld* readers who took part in our survey seem to concur with Stoodley: 64% of the respondents said their organizations still use Cobol — more than any modern language except for Java/JavaScript and Visual Basic. That figure is actually slightly higher than the response rate to a similar question in our last survey on Cobol use, from 2006. Some 62% of respondents to the 2006 survey said they still used Cobol.

In the more recent survey, over 50% of respondents said Cobol represents more than half of all internal business application code.

"There has been no renaissance for Cobol," says Accenture's Burden. "There's not a whole lot of new development going on. But our clients are enhancing their core applications and continue to maintain them." Indeed, 53% of the survey respondents said they're still building at least some new business applications in Cobol. The vast majority of that code is still being written for mainframes.

But the fact is that many IT organizations don't have much choice but to continue using Cobol. Migrating large-scale systems built in Cobol is costly and risky. "They might want something more flexible, but they just can't do it. They're captive to Cobol," Burden says.

The down economy has helped put off the inevitable, says Compuware's Vallely. "Economic issues provided everyone with a hall pass because not as many folks were looking to retire," he says. But as the economy improves, retirement plans may pick up too. "Organizations are trying to be more proactive," he adds.

> **They might want something more flexible, but they just can't do it. They're captive to Cobol.**
>
> **ADAM BURDEN,** GLOBAL APPLICATION MODERNIZATION LEAD, ACCENTURE

"No other language has seen as big an impact from changes in the demographics of the workforce as has Cobol," Vecchio says. Going forward, it will become more difficult to maintain a Cobol portfolio. "The inflection point will come when enough Cobol programmers have retired that an organization can no longer tolerate the risk," he says. At that point, most of those programs will migrate — but not all.

Rightsizing Cobol

BNY Mellon's mainframe-based Cobol batch and transaction processing programs represent a big investment. And while Gartner says it's technically possible to move individual mainframe workloads of up to 3,000 MIPS, the bank's aggregate workload, which relies heavily on Cobol, uses a total of 52,000 MIPS of horsepower, spans nine mainframes and is growing at a rate of 10% each year.

"The business wants us to make investments in programming that buys them new revenue. Rewriting an application doesn't buy them any value-add," Brown says.

Instead, the strategy is to "rightsize" some noncore applications off the mainframe where there's a business benefit, try to keep mainframe MIPS growth under 5%, and stay the course with the bank's core Cobol applications by passing on the business knowledge to younger programmers the bank will need to recruit and train (see "Closing the Talent Gap," page 24).

Other functions, such as general ledger and reporting, are moving to distributed computing platforms, where they are either replaced by packaged software or re-engineered into Java or .Net applications.

But Brown still needs Cobol programmers to replace those expected to retire, and the learning curve can last for a year or more. That means adding staff and having a period of overlap as Cobol's secrets get passed on to the next generation. "I'm trying to get those people on board and do the knowledge transfer sooner rather than later," Brown says.

But that kind of proactive approach, and the extra costs it incurs, can be a hard sell. "We haven't gotten to the point of feeling the pain yet. When we do, it will happen," he says.

Brown wouldn't specify the number of people he's hoping to hire, but he says the "real heavy need" will happen in the next five to 10 years, when the original mainframe programmers are expected to retire en force. BNY Mellon currently employs "a few hundred" Cobol programmers, he says.

Brown's concerns are well placed, says David Garza, president and CEO of Trinity Millennium Group, a software engineering firm that has handled code transformations for large businesses and government organizations. "Almost every job we get has Cobol in it," he says, and most of the calls come from organizations that have already lost their collective knowledge of the business logic. At that point, he says, a migration is "a big risk."

The Cost of Waiting

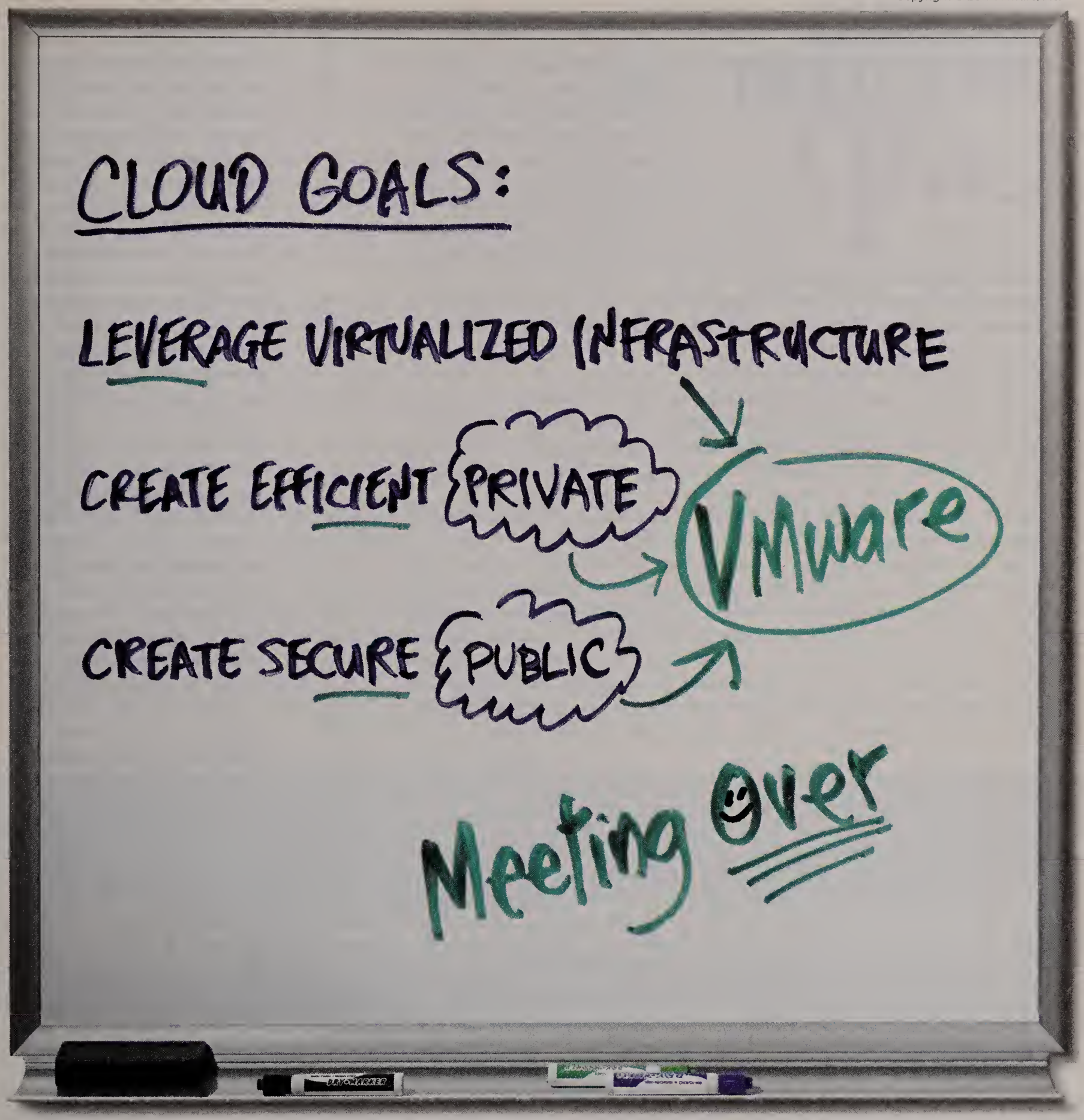
Trinity Millennium Group and similar vendors have established processes for analyzing and extracting the business rules embedded between the lines of Cobol code. "The solutions have come a long way in terms of the ability to extract logic and rules," says Burden.

But the process is time-consuming and costly. One Millennium client recently spent $1 million to have its Cobol programs analyzed and business logic reconstructed as part of a migration off of a mainframe. "If they had the legacy programmers there and we had done the exercise with them, it would have cost $200,000 and taken one-tenth of the time," Garza says. If you wait until that institutional knowledge is gone, he warns, the costs can be as much as 10 times higher than they would have been beforehand.

Compounding the loss of skills and business knowledge is the fact that, for some organizations, decades of changes have created a convoluted mess of spaghetti code that even the most experienced programmers can't figure out. "Some systems are snarled so badly that programmers aren't allowed to change the code at all," Garza says. "It's simply too risky to change it. They're frozen solid."

Jim Gwinn, CIO for the U.S. Department of Agriculture's Farm Service Agency, faced that type of situation. The USDA's System/36 and AS/400 systems run Cobol programs that process $25 billion in farm loans and programs. "We have millions of lines of Cobol, and

Continued on page 24



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CLOSING THE TALENT Gap

WHERE DO YOU FIND Cobol programmers these days? College graduates with Cobol training are in short supply. In Michigan, for example, state schools that offer Cobol programming education have cancelled classes because of a lack of interest. "They can't get anyone to enroll," says Jonathan Miller, director of information systems and services for the government of Michigan's Saginaw County. But some colleges are still providing Cobol training – with help from IBM. The mainframe vendor has developed curricula in association with more than 80 colleges and universities ranging from Brigham Young to Texas A&M.

"We donate hardware and software, help with the curriculum, and they graduate hundreds of people every year," says Kevin Stoodley, an IBM fellow and CTO.

Guardian Life Insurance has recruited Cobol programmers from Workforce Opportunity Services, a nonprofit that collaborates with business clients and local colleges to train economically disadvantaged students to work in less popular technology disciplines such as Cobol programming. "They take kids from disadvantaged neighborhoods and provide them as consultants," says former Guardian CIO Frank Wander, who now has his own consultancy, IT Excellence Institute.

"It's sort of a work-study program. We have over 200 consultants today in five states, and we're expanding," says Workforce founder Art Langer.

BNY Mellon and many other organizations also increasingly rely on outsourcers to pick up maintenance and support duties. But for many users, an offshore locale is not the place to keep the institutional knowledge of the business rules behind the code. David Brown, managing director of BNY Mellon's IT transformation group, says the bank wants those skills in-house. Fortunately, it's not all that difficult to cross-train programmers in Cobol. "Right now, it's pretty easy to hire programmers. And if they understand Java, I can bring them back to procedural languages like Cobol," Brown says. The trick is to develop a curriculum that teaches not just Cobol, but the business rules behind the code that runs the company, he says, adding, "We need to make sure we can roll that forward."

– ROBERT L. MITCHELL

Continued from page 22

there's a long history of it being rewritten," he says. "It has become increasingly difficult to change the code because of the complexity and the attrition of the knowledge base that wrote it." That's a big problem because laws that govern farm programs change every year, driving a need to update the code to reflect those changes.

Gwinn hired consultants from IBM, who concluded that rewriting the programs in a different language or rehosting them on a distributed computing platform would be complicated and costly. But the System/36 hardware had to go, so Gwinn decided to bite the bullet: The FSA will move off of its end-of-life mainframe systems by rewriting some of the code in Java and replacing the rest with packaged software from SAP.

But Gwinn says he'll miss Cobol. "It has been very stable and consistent, with little breakage due to code changes, which you see with Java-based changes," he says. "And in a distributed environment, you have to balance your workloads a little more carefully."

Going for a Rewrite

The anticipated exit of institutional knowledge and the resulting shortage of Cobol programmers were also primary drivers of NYSE Euronext's decision to re-engineer 1 million lines of Cobol on a mainframe that ran the stock exchange's post-trade systems. While Cobol was dependable, it wasn't viewed as maintainable in the long run.

Steven Hirsch, chief architect and chief data officer at NYSE Euronext, cites the need to make changes rapidly as another reason the stock exchange abandoned Cobol. "Ultimately, the code was not easily changeable in terms of what the business needed to move forward. We were pushing the envelope of what it took to scale the Cobol environment," he says.

So NYSE rewrote Cobol programs that run its post-trade systems for Ab Initio, a parallel-processing platform that runs under Linux on high-end Hewlett-Packard DL580 servers. The new environment allows for more rapid development, and the rewrite has eliminated a substantial amount of unnecessary code that had crept into the original Cobol programs over the years.

If a business's Cobol code doesn't need to change much — as is the case for many batch and transaction processing programs — then the code can be maintained on or off of the mainframe indefinitely. But that wouldn't work for NYSE Euronext. "We are a rapidly changing business, and we needed to move faster than our legacy code," Hirsch says.

As for the stock exchange's trading systems, they're all built with proprietary NYSE Euronext software. "There's no Big Iron or Cobol," Hirsch explains. "There's been no use of mainframes in the trading environment for many years."

Rehosting: Lift and Shift

When it comes to hiring new Cobol programmers, Jonathan J. Miller, director of information systems and services for Saginaw County, Mich., is struggling. "We've lost our systems programming staff," he says. And like many government IT organizations that have suffered from budget cuts, he doesn't have much to offer those in-demand Cobol programmers.

The USDA's Jim Gwinn says he'll miss Cobol.

Generous government benefits packages used to attract candidates even though salaries were lower than they are in the private sector. Now, he says, "our pay hasn't increased in eight years and benefits are diminished." The county has been forced to contract with retired employees and outsource Cobol maintenance and support to a third party — something that just 18% of *Computerworld* survey respondents said they're doing.

The Cobol brain drain is becoming critical for many government organizations, says Garza. "It's a high-risk problem in many countries [Trinity Millennium is] doing work in. The people have retired. Even the managers are gone. There's no one to talk to," he explains.

Saginaw County found itself hemmed in by the complexity of its Cobol infrastructure. It has 4 million lines of highly integrated Cobol programs that run everything from the prosecutor's office to payroll on a 46 MIPS Z9 series mainframe that is nearing the end of its life. With mainframe maintenance costs rising 10% to 20% each year, the county needs to get off the platform quickly.

But commercial software packages lack the level of integration that users expect, and Miller's team doesn't have the time or resources to do a lot of integration work or to re-engineer all of the program code for another platform.

So the county is starting a multiphase project to recompile the code with Micro Focus Visual Cobol and rehost it on Windows servers. An associated VSAM database will also be migrated to SQL Server. Miller hopes that the more modern graphical development suite will make the Cobol programming position, which has gone unfilled for two years, more attractive to prospective applicants. But he acknowledges that finding talent will still be an uphill battle.

A Legacy Continues

Is there a role for Cobol off the mainframe? "I don't believe there is. Cobol and the mainframe run well together, and that's where I want to keep it," says BNY Mellon's Brown. The bank still creates new Cobol components on the mainframe and will continue to do so.

That's a common sentiment among Accenture's large corporate customers, says Burden. Cobol will continue its gradual decline as midrange systems are retired and businesses continue to modernize legacy Cobol code or move to packaged software. Today, Cobol is no longer the strategic language on which a business builds new applications. But it still represents the "family jewels" of business, Burden says. "They're enhancing existing applications and adding functionality to them. I've seen no slowdown in those activities," he explains.

If companies can't find talent to keep that infrastructure going, third-party service providers such as Accenture are ready, says Burden. The scale of Accenture's support operation is large enough to provide a career track for Cobol programmers, and he notes that it's easy to cross-train on the language. "We can turn out new programmers quickly. If clients can't support Cobol, we will," he says.

"People make too much of that trend that we're not graduating enough Cobol programmers," says IBM's Stoodley. Preserving the institutional knowledge is what's critical. "You can make a problem for yourself if you don't keep your team vibrant," he says. But as long as there's a demand for it, "businesses will find people willing to work on Cobol."

Cobol may have been created for simpler times in application development, but it remains the bedrock of many IT infrastructures. "You have to respect the architecture of Cobol," Burden says. "I don't see that changing for another 10 years, or even longer." ◆

Mari Keefe, *editorial project manager, provided research assistance for this survey.*

managing MOBILE mania

As users bring their own technology to the workplace, companies look to **unified communications** to tie it all together.

BY MARY K. PRATT

IN THE SPACE OF JUST A FEW YEARS, Art Johnston has gone from thinking of unified communications as optional to viewing it as "a strategy that we need to implement to be competitive."

As CIO at Argo Turboserve Corp. (ATC), a Lyndhurst, N.J.-based company that provides customized supply chain management and nuclear engineering services, Johnston understands the importance of ensuring that a company's employees are able to access all their communications tools at any time, from any place.

"Our value-add to customers is in getting them immediate responses, solutions and answers," he explains. "The one thing we don't want to have is 'We'll get back to you' as an answer."

Establishing integrated, always-there communications is a tall order, considering that about half of ATC's 200 employees conduct most of their business on smartphones and tablets.

That's where unified communications comes into play.

UC brings together all of the disparate pieces of hardware and software tools that people use to stay connected — from old-fashioned telephones to mobile video chat — and makes those channels available anytime, anywhere, from any device.

Continued on page 28

DAVID ARKY / GETTY IMAGES

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Continued from page 26

"The idea is that all of that — all that different kind of communications — exists in a single interface," explains Melanie Turek, an analyst at IT research firm Frost & Sullivan.

In a perfect UC environment, an employee could receive a call on his mobile phone from someone who dialed his office line; or he could join a webconference from his laptop, access voicemail from a desktop at a satellite office and use an online "presence" application to see if a colleague is available to answer a question. And he could do all of that using a single, easy-to-navigate set of tools accessible on any and all devices.

That's the ideal Johnston is after as he makes his final choice of platform, which should be in place by midyear for most of ATC's salesforce and engineering team.

That day can't come fast enough, as far as Johnston is concerned. Unified communications "is not just a 'nice to have.' This is very important for our company to have as we go out and work with our customers and partners," he says.

UC Heats Up

Unified communications has been around for years, but interest among IT leaders has historically been more theoretical than practical, and infrastructure and cost obstacles have held back widescale implementation at many organizations.

That's changing, says Turek. Trends such as the explosion of mobile technology, the consumerization of IT and an increasingly competitive business environment are causing many IT execs to change UC's status from "optional" to "urgent."

Indeed, research firm Gartner reports that worldwide enterprise spending on UC components has gone from nearly $16.5 billion in 2008 to $17.8 billion in 2010 and should reach $18.7 billion in 2013.

And in a March 2011 survey by the Computing Technology Industry Association (CompTIA), 49% of the 600 IT and business leaders polled said their spending for UC technology would grow faster than their overall IT budgets in the coming 12 months. Large organizations — those with 500 or more employees — were the most likely to increase their unified communications investments relative to their overall IT spending, according to the survey results, which were released in June 2011.

That said, Tim Herbert, vice president of research at CompTIA, says companies are likely to find that moving forward with unified communications is a complex and costly undertaking.

According to CompTIA, organizations could pay $1,000 or more per user per month for a high-end, all-inclusive system that they host and maintain. At the other end of the spectrum, companies that choose not to set up in-house systems and instead contract with a service provider for a hosted voice-over-IP system with a basic selection of UC options could pay $25 or less per user per month.

Many companies, spurred on by gadget-happy employees, load up on new mobile technologies but soon discover that their underlying communications infrastructure, which consists of older hardware and software, isn't up to the task — and then face the fact that they need extensive infrastructure upgrades to support UC.

Also complicating any move toward full UC is the fact that many companies built their communications systems with a mix of hardware and software components from various vendors, and not all of their systems will work together in a unified manner, says Turek.

Leading UC vendors that sell complete suites include Avaya, Cisco Systems, Microsoft and Siemens, while vendors selling components that organizations can layer into UC include Citrix Online, Polycom and LifeSize Communications, along with Cisco companies WebEx and Tandberg.

[Unified communications] is not plug-and-play. It's very complex and has lots of moving parts.

MELANIE TUREK, ANALYST, FROST & SULLIVAN

"And now we're starting to see the encroachment of social media — Facebook, Twitter, Google+, LinkedIn — and Skype," Turek says.

What's more, IT leaders have to make all of that work not on a uniform collection of desktops but rather on the range of devices that employees use — often a mix of desktop PCs, laptops, smartphones and tablets. In short, UC "is not plug-and-play," says Turek. "It's very complex and has lots of moving parts."

Meeting the Demand

Given the complexity of both the problem and the solution, many organizations would prefer to move ahead slowly. But as more and more employees use mobile devices to get work done, they're looking for UC capabilities like call forwarding and voice-to-IM connectivity — and they're looking for them now.

"You have more and more people who are on the soccer field on afternoons working, or working on the weekends and in the

Continued on page 30

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Continued from page 28

evenings," Turek says. What's more, "they're bringing their own devices, and they're using social media tools, using Skype or free audioconferencing services or presence technology if the company doesn't provide it."

That's the kind of scenario that can force a company's hand: It either makes an investment in UC or resolves to live with the consequences of workers piecing together their own communications solutions, along with the questionable security and patchwork reliability that often comes with such do-it-yourself fixes.

Even so, it often takes some sort of trigger event — such as a merger, a relocation or a major phone system upgrade — to spur companies toward looking into unified communications, says James Whitemore, executive vice president of sales and marketing at UC vendor West IP Communications, in Louisville, Ky.

The Reinvestment Fund, an investment group based in Philadelphia, is one case in point.

CIO Barry Porozni says the company moved in May 2011 and is in the process of upgrading from an obsolete system to Cisco Unified Communications Manager Express, a call-processing system that combines voice, video and data. All 80 employees have land lines with a corporate number, about half of them also have company-issued smartphones, and still more bring in their own smartphones.

Porozni says different groups of workers want different UC functionality. For example, some want to use their smartphones (either personal or corporate-issued) to seamlessly access their corporate email and voicemail, while others want call forwarding between their smartphones and office phones.

The new Cisco system will support these capabilities, allowing Porozni to satisfy the various needs among the different groups.

Even so, Porozni anticipates he'll need to add additional features down the road as workers become comfortable with the various capabilities and as new features evolve. Whether it's a single number for all devices or some yet-to-be-invented feature, "there will be demand for more in the future," he predicts.

Turek says that sums up where many companies are right now: "Very few companies are doing the whole thing at once because they don't have that luxury, so they're asking, 'Where do we start?' And what comes first is generally based on the needs of the organization."

Rolling Out UC

At ATC, needs took a back seat to more practical concerns, at least for a while. Company leaders realized more than a year ago that they'd have to move toward UC but held off, aligning the timing of the installation of necessary 50MB fiber lines using MPLS technology with the company's move to a new building last year.

"We wanted to leverage off the new [infrastructure] to have a complete presence for the employees who are really mobile — and that's about half of them — so they can use smartphones and tablets for IM, phone, email and eventually videoconferencing," explains CIO Johnston, adding that he's evaluating Shoretel and Microsoft Lync suites to determine the best fit with the varying needs of his workers, who use a Microsoft desktop platform along with BlackBerries, iPhones and Android devices when on the go.

Johnston says he's looking at doing a six-month phased-in deployment, with the engineering and sales departments getting access to the UC system first.

When the first implementation is complete, he envisions a system that will allow sales and engineering personnel to use smartphones and tablets to access their desktop software, participate in webconferences, collaborate with one another via voice and video, and share documents through online sites that employees are already using, such as LinkedIn and Dropbox.

"We plan on having complete collaboration using IM, email, voice and video platforms to integrate with our CRM, ERP, DCM and BI tools," Johnston explains. "We've been working on a [bring-your-own-device] policy and how that will fit into our UC solution. Dropbox and other social networking tools have to be evaluated and will definitely have some play into the final UC process," he says.

"We want to have that complete package, so wherever they are they can access whatever they need," he adds. "It's going to be through these touchpoints that we conduct business, and the real driver of [unified communications] is doing business." ◆

Pratt *is a* Computerworld *contributing writer in Waltham, Mass. Contact her at marykpratt@verizon.net.*

tricky ROI

THOUGH IT leaders consistently list unified communications as a priority, it remains on the back burner at many organizations. One reason: ROI for UC tends to be measured in productivity improvements and other strategic advantages, rather than hard numbers that come from cost savings.

And for some companies, that can be a problem. "Everyone understands that [unified communications] would be valuable, but showing that it's valuable enough to spend hundreds of thousands of dollars to get all of this to work together? That's difficult," says Frost & Sullivan analyst Melanie Turek.

IT leaders often find it easier to demonstrate the value of pieces of the UC puzzle, says Turek. They can, for example, justify investments in instant messaging by showing the importance of knowing the availability of people in different locations. But they have a harder time showing the potential ROI of investments necessary to pull all of the pieces together.

Yet companies that actually tie the pieces together are the ones that can maximize the value of unified communications -- provided they're able to change the processes that the technologies support, says Tim Herbert, vice president of research at CompTIA.

"It's about rethinking the norms for communications and having the policies that support [those changes]," he says. "A lot of companies deploy unified communications, but if they don't take advantage of things like presence technology or sharing documents other than email attachments, then they aren't going to see the full benefits of UC."

— MARY K. PRATT

BUILD CLOUDS THAT TRANSFORM YOUR BUSINESS

The maxim "change is constant" has never been more true than today. Powering that rapid change is a connected world of many clouds that help you bring ideas and innovation to market faster. To assure that your business can efficiently and effectively take advantage of the transformative power of clouds, Cisco has developed an integrated set of solutions we call CloudVerse. With the Cloud Intelligent Network, Unified Data Center, Cloud Applications and Cloud Enablement Services, the future is yours to build.

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UP-AND-COMING TECH JOBS

Ready for your new job as an augmented reality specialist, a VP of virtualization or a customer sleuth? **Here's what you need to know.** BY MARY K. PRATT

ANY STUDY of the IT labor market is likely to find that project managers and business analysts are in demand, but what about cloud transformation officers?

BERTOLD WERKMANN / FOTOLIA

With big data, mobile computing, social media, cloud computing and the consumerization of IT all converging on IT, some new — and intriguing — job titles are beginning to emerge.

Computerworld went digging and unearthed a handful of positions you can expect to see popping up more and more — along with details on what you'll need to land one of them. If current trends prevail, your career could include a stint as a data scientist, an augmented reality specialist or a chief agile officer.

Director of Cloud Transformation

As companies move from the client/server world to one where systems reside in the cloud, they're hiring professionals to oversee the entire strategy, says Al Delattre, global industry lead for technology at Los Angeles recruiting firm Korn/Ferry International.

Whether the position's called director of cloud transformation, vice president of virtualization or cloud transformation officer — all of those titles are floating out there in enterprise IT — the job description remains roughly the same: Oversee all the moving parts required to migrate to the cloud, Delattre says.

"This position is like being a conductor of an orchestra. It's a series of 500 projects over seven years. You have to make sure it works and it's sequenced," he says. "No one person is an expert on all of it," which means multiple specialists are often involved — and that, in turn, spurs some companies to seek out an overseeing director.

Skills required: Delattre likens the move to the cloud to the big ERP projects of past decades. Now, as then, companies are looking to hire people who can show that they're able to plan, control and deliver complex, high-risk projects involving technology that's evolving even as the project is under way. "You've got to have that track record. You want someone who has landed on the moon and returned before," Delattre says.

They're also looking for deep knowledge of the organization's applications. "You have to understand the parts you're working with. You need to understand what's in there now," he says. "You need to know that [someone] might have put in a patch 10 years ago and never documented it."

Finally, they're looking for folks skilled in negotiating with and managing vendors. "There is absolutely a skill requirement around procurement, because so much of this is about procuring services," says Delattre.

Once an organization successfully moves to the cloud, does the job go away? Given the complexity of the task, Delattre says, cloud transition managers can expect to stay busy for at least the next several years, before transitions are complete and the job morphs into one focused on maintenance.

"This is a two-to-five-to-seven-year run, similar to what happened when we went from mainframe to client/server and then again when we went to the Web," Delattre says.

Socialite

Companies of every size and stripe are implementing ever more ambitious strategies involving social media, so it's only logical that they need technologists who can make the most of their investments, says Rachel Russell, director of marketing at Hanover, Md.-based IT staffing firm TEKsystems.

Some companies are hiring people who understand the marketing value of social media as well as its technical complexities. In most organizations, social media has, until recently, been under the purview of either IT or the marketing department. Now, organizations are putting a new crossbreed of talent into jobs with titles like chief social media strategist, new media coordinator, manager of social media and (less frequently) socialite.

"What you'll see with these positions is a tie-in to strategy. Companies want someone who can help them understand and define what the strategy is; [someone to say] 'Here's what we want the social media strategy to be,' " says Matthew Ripaldi, a senior vice president at Modis, an IT staffing firm in Jacksonville, Fla.

The role isn't about sending out tweets and posting on Facebook all day, he clarifies. It's about leveraging technology to monitor online activity and interactions and to engage consumers.

Skills required: The ideal candidate is someone who has a strong background in business strategy and marketing with project management and business intelligence experience mixed in — and a technical background, with skills in HTML and Web rendering, Ripaldi says.

And as if that standard weren't high enough, companies also want people with proven experience. Strong candidates would have solid experience in marketing and could demonstrate the ROI of their past marketing projects, Ripaldi says.

Techies who specialize in social media must understand business needs, says Rachel Russell of TEKsystems.

At TEKsystems, "when we're interviewing IT professionals, we want to hear about what projects they worked on and what they did for the business," says Russell. "What business stakeholders did you work with? What were the challenges? If they can answer those, [we see that] they get what they're doing."

In a move that may be welcome news to IT types, some organizations are going so far as to create more than one specialized social-media-oriented position. They're hiring a high-level executive to develop a strategy and then hiring a midtier techie as a social media architect, engineer or developer. The techies typically have expertise in coding, HTML, website development, graphical user interfaces and search engine optimization.

Data Scientist

Big data is on the agenda of nearly every future-focused operation, for good reason. "Organizations are drowning in the amount of data that comes in, but it's all very siloed. People have the information, but they can't find it," says Daniel Burrus, founder and CEO of Burrus Research Associates in Hartland, Wis., and the author of *Flash Foresight: How to See the Invisible and Do the Impossible.*

So enterprises need a new breed of worker who understands how to collect, interpret and analyze vast amounts of data in a way that's truly useful for making business decisions.

"There's a huge explosion of consumer data, and every company that's even close to a consumer market is trying to figure out what to do with all this data — to move it from data to insight to actionable items instantaneously," says Korn/Ferry's Delattre.

Skills required: Like many of the other hot jobs in IT, this specialty requires the right combination of business and technical skills. The ideal candidate needs to be familiar with sophisticated algorithms, analytics and marketing — and with ultra-high-speed computing, data mining, statistics and even artificial intelligence.

"IT needs to understand what questions the business [is] trying to answer so it can make better business decisions faster and cheaper," Russell explains. A data scientist "has to know where all the data is and how to push it out, but also what data is the biggest priority, where did it originate, and how to structure the business process so there's no garbage in and garbage out," she adds.

"You need process management skills and communication skills, so you can say, 'I can build this for you, but we need a partnership because a tool alone isn't going to get us what we need,' " Russell explains.

The data scientist position goes beyond the skills generally seen in a BI analyst. These new specialists will not only find and deliver the information; they will also be the ones using it for extensive forecasting. "You want someone who can take the raw data and apply it in order to predict [customer] behavior," Delattre says.

Delattre describes the ideal candidate as someone with an undergraduate degree in computer science and a master's in marketing with some operations management expertise. It's a specialized skill set, he admits, but anyone with those credentials could step into the new positions being created under titles like chief market scientist, chief data analyst and the more creative-sounding customer sleuth.

Augmented Reality Specialist

Companies building apps that are designed to enhance how people view the world around them need technologists who can deliver that experience. And demand for people with that expertise is expected to grow, according to Burrus.

Companies are increasingly working to deliver software that enables people to view a landscape, a street or a mall, for example, through the lens of a smartphone or tablet and get information about the things they see in front of them. A view of the landscape might, for example, display the heights of mountains and the number of vacancies at nearby lodges, while scenes of a city street or a mall would show which restaurants have lunch specials or which stores have the best prices on particular products.

Skills required: Required technical skills include programming experience in HTML5 and the iOS and Android platforms, as well as graphics expertise — specifically 3D modeling skills that include texturing, shading and rendering.

Beyond that, Burrus says, augmented reality specialists also need a particular mindset to be successful. "It will require an open, flexible mind," he says, explaining that these people need to be able to visualize how to combine technologies in new ways to produce new results.

New jobs are usually tied to new technologies, says Georgia Tech professor Sandra A. Slaughter.

More Tech Titles of the Future

It's no surprise that new tech job titles tend to emerge during times of great change in the industry. "When you look at what's emerging today, usually the new jobs are tied to the new technologies," says Sandra A. Slaughter, a professor of information technology management at the Georgia Institute of Technology College of Management.

Slaughter and other industry watchers listed these as some of the jobs out on the high-tech horizon:

Chief agile officer: As more organizations move from the linear and sequential waterfall model of development to agile development, with its iterative approach, they're looking for leaders to help with the transformation. Branndon Kelley, CIO at American Municipal Power, says he has seen these people hold titles such as chief transformation officer or agile coach. He says they're typically charged with building the methodologies that will lead an organization through a changing environment.

Flexible resource manager: Because IT is in a state of constant evolution, some departments are starting to hire people who can foresee what skills will be needed and how long they'll be needed, says TEKsystems' Russell. These managers are also responsible for bringing people with new talents into the organization and integrating them with existing staff to assemble high-performance teams.

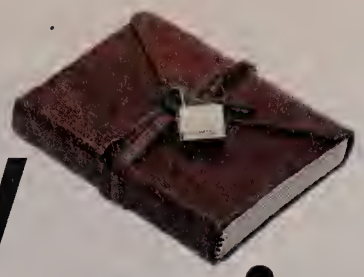
Health informatics expert: As healthcare becomes an ever larger and ever more computerized industry, employers are seeking technologists who can optimize the acquisition, storage, retrieval and application of health-related data. Ideally, health informatics experts will understand not only IT, but also the unique needs of the clinical care community. "In some ways, it's taking things we already know how to do and tailoring them, developing new systems for the healthcare system," Slaughter explains.

Machine-to-machine communications enabler: Machine-to-machine communications is already present in some industries, though the application of such technology is in its early stages, according to Burrus. As companies expand their use of such communications, they'll need more and more people to develop, deploy and manage the technology.

Outsourcing/offshoring manager: "Outsourcing and offshoring are getting more complicated," Slaughter says. "The work may be going on in four or five different places now, not just in one place, so you need someone who can manage all the projects." ◆

Pratt *is a* Computerworld *contributing writer in Waltham, Mass. Contact her at marykpratt@verizon.net.*

Security Manager's Journal



MATHIAS THURMAN

Red Alert for Child Pornography

A .mov file with a highly suggestive name is enough to kick off an investigation into what's on an employee's PC.

WHEN YOU WORK in any kind of security field, you are always coming up against the uglier aspects of mankind. Let's face it: There wouldn't be any malware, unauthorized access or laptop theft if humans weren't imperfect beings. In my work, I have come to accept that this is the way things are, and I don't even mind dealing with those sorts of incidents. In fact, such incidents are why people like me are necessary.

Not that I have much fondness for people who disseminate malware, steal laptops or try to breach systems, but they aren't as repulsive as another class of criminal you find on the Web: child pornographers. And this week we had an incident that suggests that one of our employees might be one of the latter.

I say "might" because the evidence at this point is sketchy, and we have much more investigating to do. What we know at this time is that an employee in Europe had a .mov file on his G drive with a name that indicated the video potentially involved child pornography. This came to light when an administrator was training someone on how to manage our antivirus infrastructure. They were going over reports of machines with infected files when they spotted the suspect .mov file.

The admin told me about this at once, and I called a meeting with the heads of HR and Legal. We decided that our first course of action should be to contact local police in Europe. What we could tell them was that only one file had been detected, that we weren't able to validate that the file was child pornography, and that the employee was currently on vacation in Greece.

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After a few days, the police let us know that they didn't want to take the case, on the grounds that a single suspect image didn't warrant an investigation. How many images would spur an investigation? we asked. Their answer was many more than one.

Internal Affairs

Nonetheless, the vice presidents of HR and Legal wanted to conduct an internal investigation, so they asked me to determine whether there were any other images on the drive.

The suspect was still on vacation and had his laptop with him, and I thought he might check in from time to time since he'd bothered to take the laptop along. We run Symantec Altiris for centralized configuration management and software distribution, and I asked the administrator to create a special job to inventory the PC the next time it accessed the network. After a few days, it did. The Altiris inventory scan showed that the suspect didn't have the external-media G drive plugged in, and there were no files of a suspicious nature on the hard drive itself.

A few days later, the suspect did connect an external drive, but the Altiris inventory of that still revealed nothing other than a bunch of standard image-file names.

In the meantime, HR was trying to figure out what they should do with this guy when he returned to the office. My advice was to relax and not jump to conclusions; there was just one file that seemed suspect, and there might be an innocent explanation for it.

But because we wanted to do a thorough investigation and not let a potential child pornographer get away, we told the employee's manager to confiscate the laptop (and attempt to obtain the external media device, which we can confiscate only if it is company property) as soon as the employee returned. To avoid making the employee suspicious, we advised the manager to say that the machine is infected with a bad virus.

I wish it were something so simple. ◆

This week's journal is written by a real security manager, ***"Mathias Thurman,"*** *whose name and employer have been disguised for obvious reasons. Contact him at mathias_thurman@yahoo.com.*

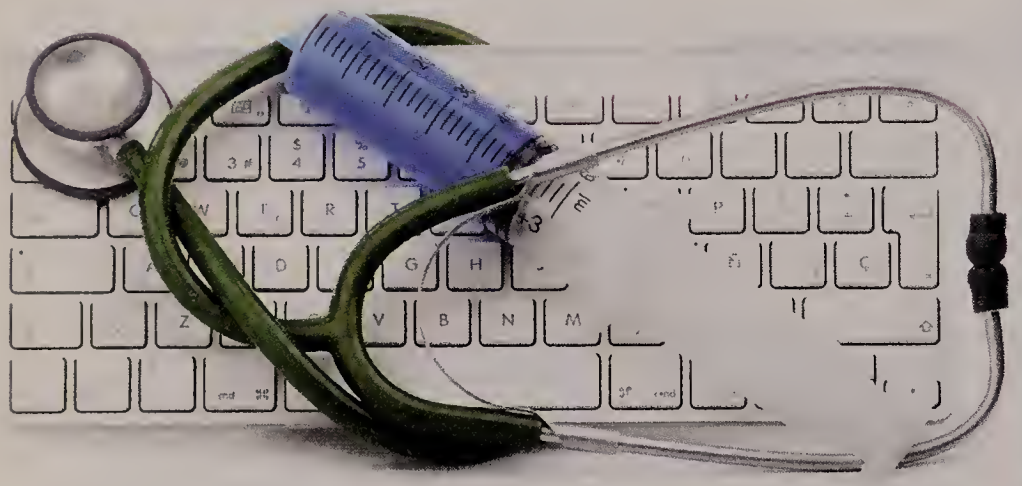
"The evidence at this point is sketchy, and we have much more investigating to do.

Trouble Ticket

At issue: A routine review of antivirus reports turns up a file that could be child pornography.

Action plan: Contact the authorities and try to determine whether this incident is a misunderstanding or real evidence of criminal behavior.

Career Watch



Talking Up IT Jobs

U.S. News & World Report published its report on the "Best Jobs of 2012" in February, and several IT positions showed up in the top 10.

The magazine's rankings are largely determined by expected job openings in each field (using the Bureau of Labor Statistics projections that have been mentioned on this page several times), but other factors are considered, including average salaries and job satisfaction (using metrics provided by Glassdoor). The jobs that rose to the top using that formula were predominantly in healthcare and technology. **Possible takeaway: It might be best to look for an IT job in the healthcare sector.**

U.S. News followed up that report with one in March on the best job prospects for MBA graduates, based on expected openings. In that case, IT held the top three positions.

TOP 10 JOBS OF 2012

1	Registered nurse
2	Software developer
3	Pharmacist
4	Medical assistant
5	Database administrator
6	Web developer
7	Computer systems analyst
8	Physical therapist
9	Computer programmer
10	Occupational therapist

TOP JOBS FOR MBA GRADUATES

1	Database administrator
2	Web developer
3	Computer systems analyst
4	Accountant
5	Financial adviser
6	HR specialist
7	Financial analyst
8	Management analyst

SOURCE: *U.S. NEWS & WORLD REPORT*, FEBRUARY AND MARCH 2012

FOTOLIA / RUGERCM

ASK A PREMIER 100 IT LEADER

Allan Hackney

The CIO at John Hancock Financial Services answers questions about **cloud computing as a career** *and more.*

My friends in IT seem to be moving toward jobs at cloud computing firms. I'm in IT operations at a traditional company. Am I missing the boat? There are two sides to the cloud computing coin: the buy and the sell. I surmise from your question that your friends are moving to sell-side consultancy and delivery firms. This is a fast-growing industry, and as a result, there's a willingness among employers to make attractive offers to find talent. But don't lose sight of the fact that in due course the buy side will be a much larger employer of cloud talent by orders of magnitude. If you're at a traditional company, now is your moment to step up and lead the charge. You can really distinguish yourself as your company's cloud expert (as opposed to being one of many at a cloud vendor or consultancy).

If you have a question for one of our Premier 100 IT Leaders, send it to **askaleader@computerworld.com,** and watch for this column each month.

I've been out of work for over a year. As much as I love the tech life (15 years, mostly in networking), I'm thinking about bailing out of IT. Do you think it's worth hanging in there? If so, what can I do while unemployed to make myself more marketable? When I recently received an email from my eight-year-old niece (who's using computers at an age when I could barely scrawl my name with a pencil), I realized that the role of the IT function as the gatekeeper of the technology domain was changing forever. You may needlessly constrain the universe of possibilities if you define your role narrowly to networking or the IT function. Ask yourself about problems you've dealt with, how you successfully solved them and the business value that resulted. If you describe yourself to the world this way, you'll find there are a lot of opportunities to pursue.

I see a lot of advice on making résumés attention-getting. What gets your attention? People spend way too much time fussing over résumés. Most jobs at my company generate between 200 and 500 applicants. It's impractical to read all of these meticulously crafted documents. When I look at résumés, I want to see three things in the opening summary: the problems that the person solves, the context or approach that is used, and how genuine value results from that. The rest of the résumé should provide a list of roles, with a fact-based example that supports the problem/approach/value statement in the summary for the most recent assignments. Make sure to list credentials such as education, licenses, language skills, published reports and so forth. Also, personal items should be included that support the summary (e.g., perform such-and-such function for a nonprofit). Keep it to two pages. Lastly, have someone besides yourself do the proofreading – spelling and grammar mistakes mean "game over" no matter how brilliant you may otherwise be.

IT|careers

Software Engineer Positions (Kirkland and Seattle, WA): Design, develop, modify, and/or test sw needed for various internet search engine co. projects. Interested candidates send resume to: Google Inc., PO Box 26184 San Francisco, CA 94126 attn: Christine Doyle. Req'd exp. below, please reference job #:
#1615.479 - database; large scale data process; query process & optimization; large scale distributed systems; & oo program.
#1615.1121 - C++ or Java on Linux; multi-thread & parallel program; oo develop; large scale distrib system design & dev; distrib system simulation & perf analysis; cloud storage systems; linear & non-linear optimization problems; info security & applied crypt; web dev flow; & HTML, XML, CSS, Jscript, AJAX, Shell & SQL.
#1615.780 - oo program; Java, HTML/CSS/Jscript; database & database tools, incl. NoSql, MySql, & PostgreSQL; & enterprise-level sw dev.
#1615.3536 - algorithms; distrib systems, data structures, database systems, networking protocols & systems; Java or C#;C++; & oo design patterns.
Product Mgr Position (Kirkland, WA) #1615.907 - Take responsibility for Google product from conception to launch. Req'd exp. Includes: design & arch of cust facing products & drive major cross functional projects involving multiple org.; design intl. products in multiple locales & languages; design & implement highly available, scalable & distrib internet systems; & direct sw develop covering the sw lifecycle. Up to 25% travel is req.

SW Eng. Positions (Mountain View,CA): Design, develop, modify, and/or test sw needed for various internet search engine co. projects. Interested candidates send resume to: Google Inc., PO Box 26184 San Francisco, CA 94126 attn: Christine Doyle. Req'd exp. below, please reference job #: #1615.856: C or C++; Java; mobile op systems; JScript; HTML; CSS; AJAX; UI design; search ranking; data mining; & machine learning.
#1615.1949: graphics concepts & perform; graphics APIs, incl. OpenGL, OpenGL ES, & DIrectX; shading languages, incl. GLSL & HLSL; C++; STL; multi process & IPC arch; Jscript: sw dev for Windows, Linux & Mac; & compiler tech.
#1615.2041, distributed backend sys; front end dev; & C, C++, and/or Java.
#1615.564: C, C++, Java, Python, SQL, machine learning, data mining, MapReduce, distributed sys & data extract.
#1615.1777- C, C++, kernel prog, multithreaded appl, large scale distributed sys, & distributed storage sys.
Tech. Solutions Eng. Position (Mountain View, CA) #1615.998 - Integrate Google products with customer technology. Req'd exp incl: Unix, C++, J2EE Java, XML, Net, C#, Perl, Ruby, Python, Emacs SQL, Lisp, Visual Basic; & travel industry.

Sr. Programmer Analysts/ Business Intelligence Developers. Des & develop BI sys for strategic decision-making using Microstrategy reporting tools & technologies such as SQL, Netezza, Oracle on Windows, Unix, Linux platform. Des & impl dimensional model for data warehousing. Reqs BS, MS or foreign equiv in CS, Engg, Math, Bus Mgmt, Acctng or related w/ 3-5yrs exp in job offered or related technical/ analytical role, or any suitable comb of educ/training/exper equiv to actual min reqmts. Exper can be concurrent. Multiple positions. Job loc: Rockville,MD. May require travel or relocation. Mail resumes to HR, ITC Software Solutions Group, LLC, 201 E. Sandpointe Ave, #300, Santa Ana, CA 92707. EOE.

PeopleSoft System Administrator - Utilize PeopleSoft Tools, Change Assistant, Apps Designer, Data Mover, SQR, SQL, Query, nVision, and Crystal Report. Manage, and monitor PIA, Tuxedo, PeopleSoft Domains, WebLogic and Process Schedulers. Install and configure PeopleSoft system on Linux/ Windows including Oracle Database, Application Servers, Batch Servers, and Web Servers. Customize and deploy security for PeopleSoft system including row level security, roles, permission lists, user profiles, user preferences, query security, portal security, and sign on security. Must have M.S. In IT and training certification in PeopleSoft Security and PeopleSoft Tools. Must have permanent U.S. work authorization. Send resumes to K. Stefanek, Parkview Hospital, 2200 Randallia Dr., Ft Wayne, IN 46805.

Sr. Programmer Analysts (NY IT firm): Devlp & write comp. progs to store, locate & retrieve specific docs, data & info. Desgn, devlp & implmnt next gen IP Platforms using tools & s/w w/ backend databases to provide integrated mgmt sys. Convert project specs & stats of probs, procedures, detailed logical flow charts / coding comp language. Good combo of edu, trng & exp equal to Masts OR accept Bachs + 5 yrs of related exp. Major field of study is req In CS, Engg (any), Sci (any), MIS, Math. Visit clients in U.S. on short notice is req. Mon-Fri 9-5pm. Offer standard emplynt benefits. Apply w/2 copies of res : Landmark Technologies Inc. 421 7th Ave, Ste 1007, NY, NY 10001

Sr. Business Systems Analyst (Little Canada/MN): Lead functional analysis and business process requirement design. Req. Master or equiv deg/Computer Applications, C'sci-C'eng, plus 2-yr exp in Business Systems Analyst designing public pension benefit functional/business system. Exp should include Java or MS.Net & Ms.Visio, SQL, IBM Mainframe,COBOL. Send resume+salary req to: HR, Sagitec Solutions, 422 County Rd D East, Little Canada, MN 55117.

eGain Communications Corporation in Sunnyvale, CA has two (2) available positions:

1. Sr. Solutions Architect (Ref. # 201232)

2. Sr. Solutions Architect (Ref. # 201233)

For more information or to apply, email your resume to careers@egain.com EOE

Bill Me Later, an eBay co., seeks Software QA Engineer 3 in Timonium, MD: Perform testing across suite of financial products. Execute testing w/in extremely fast-paced agile environment. Working from home is an option. Occasional travel to Bill Me Later office in Timonium, MD is required. Req's: MS (or equiv.) + 3 yrs exp. or BS (or equiv.) + 5 yrs exp. Must be legally authorized to work in US w/o sponsorship. Submit resume w/ ref. to: Req.#:SK181(CW) to: HR (Cube 4120B), eBay, Inc. HQ, 2065 Hamilton Ave., San Jose, CA 95125. EOE

Ness USA, Inc. seeks Senior Community Manager (Content) in San Jose, CA: Review & edit communications, spanning a brand's community prod. cycle. Prov. insight & direction in editing content; set & execute corp. community dev. strategy. Must be willing to travel and/or relocate to various unanticipated places in the United States for the position. Req's: MS (or equiv.) +4 yrs exp. or BS (or equiv.) +6 yrs exp. Submit resume w/ ref. to: Req. #1A(CW), to: Ness USA Inc., 226 Airport Pkwy Ste # 470, San Jose, CA 95110

DataLinx Corporation- East Brunswick, NJ. Computer Systems Engineer- Travel & work at various unanticipated client sites required. Participate in detailed business requirements gathering & analysis. Convert client business needs into system requirements, high level design, & application interface design artifacts for coding. Requires Bachelor's in Comp. Sci., Comp. Eng., Eng., or rel. field + 5 yrs. of experience in a related telecommunications technologies position. Please send resume to: Anju Mohan, Datalinx Corporation, 1 Tower Center Blvd., Floor 18, East Brunswick, NJ 08816. Reference CSE001.

Computer Professionals for NY based IT Firm: Sr. Programmer Analyst: Plan, design, develop, enhance, customize & co-ordinate activities to implement advance software module components in complex computer environments. Consult with Users & Developers to assess computing needs & system requirements. Plan backup and security. Exp in Java, Ajax, Tomcat, UNIX, Rational Application Developer, Jdbc etc. Apply w/2 copies of resume to HR, Jean Martin, Inc., 551 Fifth Avenue, Suite 1425, New York, NY 10176

DataLinx Corporation- East Brunswick, NJ. Senior Network Architect- Travel & work at various unanticipated client sites required. Design, implement & support medium to large complex networks in the service provider industry. Requires Bachelor's in Comp. Sci., Eng., or rel. field + 4 yrs. in any rel. technical position. Will accept a combination of education & exp. as determined by a qualified evaluation service as equivalent to a Bachelor's degree. Please send resume to: Anju Mohan, Datalinx Corporation, 1 Tower Center Blvd., Floor 18, East Brunswick, NJ 08816. Reference SNA001.

DataLinx Corporation- East Brunswick, NJ. Senior Systems Architect- Travel & work at various unanticipated client sites required. Perform IT system design & architecture, implementing & supporting medium to large environments in service provider industry; configure, install, & troubleshoot applications for vendors. Requires Master's in Comp. Sci., Elec. Eng., or rel. field + 2 yrs. exp. in rel. technical position performing design & architecture. Will accept Bachelor's degree + 5 yrs. of exp. Please send resume to: Anju Mohan, Datalinx Corporation, 1 Tower Center Blvd., Floor 18, East Brunswick, NJ 08816. Reference SSA001.

Computer Professionals for (Mt. Prospect, IL) IT firm: Sr. Software Engineers, Sr. Programmer Analysts, needed. Bachelor or Master degree in Engineering (any), MIS, Comp. Science, Math with or without experience required depending on the level of position. Will accept equivalent foreign degrees. Will also accept Bachelors with 5 years of experience as equal to Masters degree. Offer standard employment benefits. Apply w/2 copies of resume to HR, Ecap & Sol, Inc, 800 E Northwest Highway, #108, Mt. Prospect, IL 60056.

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SHARK TANK

TRUE TALES OF IT LIFE AS TOLD TO SHARKY

HAL MAYFORTH

Screwy Laptop Problem

Tech-savvy manager pilot fish gets a new laptop from IT, with his applications and documents ready to go, and it works fine. "After using it all day with no issues, I shut down, removed the laptop from the docking station and packed it in my computer bag for the ride home," says fish. But the next morning, when he puts it back in the dock and powers up, the screen just displays a strange line of text, followed by an ongoing, progressing pattern fish has never seen before. He restarts the laptop. Same result. He takes it out of the dock and restarts it. Still doesn't help. He calls IT, and the support tech is stumped, too. But just as the tech is about to take the laptop away, an employee in a nearby cube calls out, "Does it have a hard drive in it?" Reports fish, "The tech stopped dead in his tracks and turned the computer over. Sure enough, the drive slot was empty. In the bottom of my computer bag was a loose hard drive. Someone forgot to put the retaining screws in when the computer was configured."

If It Beeps, We Call IT

None-too-seasoned support tech is summoned on an urgent mission to the board room, where the esteemed members of the board of directors are looking really annoyed, according to this pilot fish on the scene. "Something was regularly beeping," fish says. "*Turn it off!* was the directive. The somewhat novice tech searched frantically, checking the projector, control panel, TVs and interactive whiteboard, finding nothing obvious. The beeping continued. The directors' exasperation increased. Tech texted the network admin, who came to the scene and shut down everything from the control panel. Yet the beeping continued. The displeasure was obvious on faces around the table. The maintenance guy arrived with a ladder and popped ceiling tiles to check wires, then descended the ladder and dropped to the floor, crawling on hands and knees under the table to check floor plates. He stopped at the feet of the chairman of the board. A meek voice from under the table stilled the room: 'Um, excuse me, but do you have a cellphone in your pocket and could you please check it?' "

Where Do I Start?

This IT pilot fish is in his company's parking lot when another employee approaches him. "You know this one: the I-have-a-question walk," says fish. "This end user explained that the wireless connection on his home computer was saying, 'No Internet access,' and asked how one would correct this problem. I asked about his wireless source – can he reboot the wireless router? No, he replied. Why not? I asked. He said, 'Well, I'm borrowing the wireless from the public library next-door. Can you tell me what I'm doing wrong?' "

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PAUL GLEN

Edgy Communication

> When we techies hear a good idea, we start mentally wandering its edges, testing its validity.

Paul Glen, CEO of Leading Geeks, is devoted to clarifying the murky world of human emotion for people who gravitate toward concrete thinking. His newest book is *8 Steps to Restoring Client Trust: A Professional's Guide to Managing Client Conflict*. You can contact him at info@leadinggeeks.com.

WE TECHIES NEED to take the edge off once in a while.

As I've sought to improve the way we communicate with nontechies, I've recognized that we often resort to a surefire way to confound, if not irritate, them: We talk about what I call edge cases.

I do it all the time. Say a colleague makes a suggestion. If the idea sounds good, I start mentally wandering its edges, testing its validity. When I find an edge case where the idea wouldn't work, I blurt it out, wanting to show that I am giving the suggestion my full attention. To me, the edge case could indicate that there will be things that we'll need to address that aren't immediately apparent, or it could help prevent us from pursuing a path that would ultimately prove fruitless.

To my surprise, though, my colleagues get upset. That can be confusing to the techie in the conversation. Isn't it helpful to pursue new ideas with logic and discover the areas where they might fail? We think it is. But as is so often the case, we just aren't able to see things the way the nontechnical folks do. As far as they're concerned, we might as well have just greeted their idea by saying, "Well, it won't work when there's a full moon on a Tuesday." They can't help but feel that we are being deliberately negative and unhelpful. We seem to be disruptive to the flow of idea generation, dismissive of the potential advantages of the idea and oblivious to the big picture. We come off as know-it-alls who can't resist a chance to show that we know better.

Of course, you're probably screaming that technology has to account for edge cases. It's true. But once I started noticing a pattern in my edge-case statements, I realized that it occurs in all my conversations. I saw that what feels to me like a commitment to completeness and truth leads me to bring in edge cases at inappropriate times — for example, during brainstorming and strategic discussions. When people are in the middle of thinking up new approaches and ideas, edge cases tend to disrupt their flow of thought. And big-picture discussions are about, well, the big picture. Small exceptions are not only unimportant; they also distract from what is important.

The best times to bring up edge cases are when they add genuine value: when it's time to vet the ideas that came out of the brainstorming session, and when we get to the detailed planning. Edge cases are an essential element in identifying the complexity, costs, obstacles and benefits of ideas. And no idea, no matter how good, has been adequately addressed if we haven't accounted for edge cases in our plans.

Beyond that, we can take a better approach to the way we talk about edge cases. I've noticed that when I'm in edge-case mode, I don't preface my observations with an acknowledgment that the idea itself has merit. That means the others have no way of knowing that I'm not rejecting their ideas outright or missing their points entirely.

We should also calibrate just how edgy our edge case is. It's natural for co-workers to assume that attention equates to importance. If you spend 20% of a meeting talking about a use case that represents 0.05% of system usage, they'll think you're obsessed with unimportant things. Referencing the likelihood of an edge case happening reassures them that you get the context and importance.

Although completeness and perfection are important in code, conversations are not code. They're part of human relationships. Learning to use this powerful analytical tool appropriately is essential to working effectively with nongeeks. ◆

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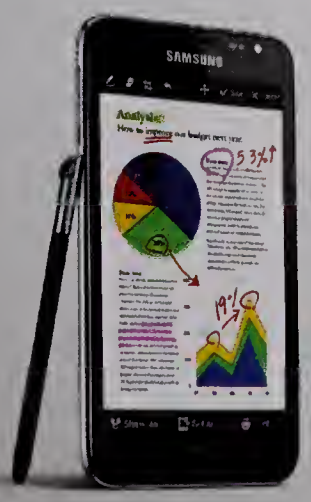

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